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The identity of *Waldo parasiticus* (Dall, 1876) and description of *Waldo trapezialis* new species (Bivalvia: Galleomatoidea)

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ABSTRACT

The epibiontic bivalve *Waldo parasiticus* (Dall, 1876), originally described as a leptonid species, is redescribed and figured on the basis of shell morphology, soft-part anatomy and reproduction. The complete synonymy of *W. parasiticus* is given, and a **lectotype is designated** and figured. *Waldo trapezialis* new species from South Georgia Islands is described and illustrated. The genus *Waldo* Nicol, 1966 is recognized as valid and redescribed.

Additional key words: Antarctica, bivalves, *Lepton parasiticum.*

INTRODUCTION

Lepton parasiticum Dall, 1876, was described based upon specimens living as "commensals" on irregular echinoids collected at the Kerguelen Islands. Dall's (1876) original description was adequate, but without illustration. Soot-Ryen (1959) reported and figured *Lepton* cf. *parasiticum* from southern Chile, and Arnaud (1964) reported *L. parasiticum* from Adelia Land, Antarctica, and the Kerguelen Islands. Moreover, four species with similar shell features and habitat were described from Antarctic and Subantarctic waters: *Lepton costulatum* Martens, 1885, *Scioberetia australis* Bernard, 1895, *Solecardia antarctica* Hedley, 1911, and *Montacuta christenseni* Grieg, 1929. Their descriptions were based mainly on shell characters, and most of them were imprecise. With the sole exception of *S. antarctica* reported by Mühllenhard-Siegel (1989) and Linse (1997), none of them have been found again after their original description. At present, as previously noted by Dell (1990), "the relationship of *Lepton* [= *Waldo*] *parasiticum* with similar species living in association with echinoderms remains uncertain".

Waldo parasiticus has been listed under different neoleptonid genera: *Lepton, Notolepton, Neolepton,* and *Neodavisia* (Dall, 1876; Arnaud, 1964; Osorio and Bahamonde, 1970 and F. R. Bernard, 1983, respectively). By studying the types of *Lepton parasiticum,* Nicol (1966) found differences in shell sculpture and hinge characters sufficient to propose *Waldo,* as a new genus of Neoleptonidae. In a systematic revision of the Neoleptonidae, Salas and Gofas (1998) excluded *Lepton parasiticum* from that family, suggesting that this species most likely belongs to the Montacutidae or Galeommatidae.

In the present paper, the placement of "*Lepton*" *parasiticum* Dall in the genus *Waldo* is confirmed, and new data on anatomy, shell characters, reproductive biology, and host specificity are given. In addition, *Waldo trapezialis* new species is described.

MATERIALS AND METHODS

The specimens used in this study were collected by the R/V Eduardo L. Holmberg during the 1995 cruise to South Georgia Islands (Figure 1) and the R/V Polarstern during the 2002 Latin American Polarstern Study (LAMPOS). Specimens were studied and figured using scanning electron microscopy (SEM); shell measurements were recorded using a stereoscopic microscope equipped with micrometer eyepiece (for all calculations mean and standard deviations are given). Several alcohol-preserved specimens of *Waldo parasiticus* new species were processed for histology by decalcification in a Raillet-Henry's solution, followed by dehydration, embedding in Paraplast®, sectioning (7 μm thickness) and staining with hematoxylin-eosin (Gabe, 1968).

Additional specimens from the National Museum of Natural History, Washington (USNM), and others obtained from dried samples of echinoids housed at the collection of Invertebrates, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (MACN) were studied. Type specimens of *Lepton parasiticum* (USNM), and *Montacuta christenseni* from Bergen Museum, Norway (BM), were studied. The type material of *Scioberetia australis* (consisting of fragments of one shell, two 1 mm-long juveniles and a series of histolog-

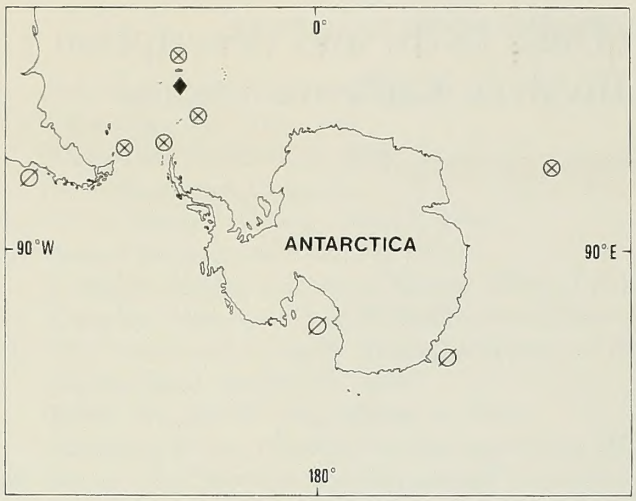


Figure 1. Location map. ⊗: localities for *Waldo parasiticus* (this work); ø: other known records for *W. parasiticus*; ♦: localities for *Waldo trapezialis* new species.

ical sections) from the Muséum National d'Histoire Naturelle, Paris (MNHN) were also used for comparative purposes.

SYSTEMATICS

Genus *Waldo* Nicol, 1966

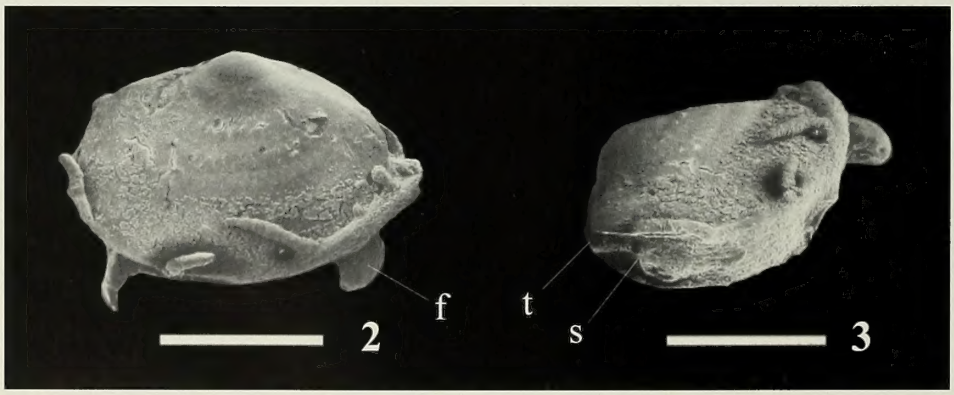
Description: Shell small (up to 4.1 mm), extremely fragile, elongate-oval or subquadrangular, equivalve, gapping at anterior, posterior and ventral margins. Shell surface smooth or with radial ribs. Hinge edentulous in adults; ligament internal, strong, and external periostracal ligament present. Mantle border expanded beyond the shell margin, bearing a variable number of stout tentacles. Free edges of mantle border expanding anteriorly in a temporary inhalant structure; only exhalant siphon, present. Only one demibranch, the inner, present. Foot cylindrical, with a well-marked heel and strong byssal gland. Epibionts on irregular echinoids.

Waldo parasiticus (Dall, 1876)
(Figures 2–22)

Lepton parasiticum Dall, 1876: 45–46.
Lepton costulatum Martens, 1885: 94; Martens and Pfeffer, 1886: 115 (South Georgia Islands).
?*Solecardia antarctica* Hedley, 1911: 4, pl. 1, fig.5; Mühlenhard-Siegel, 1989: 164, pl. 3, fig. 28, pl. 7, fig. 28; Linse, 1997: 55, pl 2, figs.1–3 (Cape Royds).
Montacuta christenseni Grieg, 1929: 14 (Admiralty Bay, South Shetland Islands).
Lepton cf. *parasiticum*.—Soot-Ryen, 1959: 49, pl. 2, fig. 19.
Notolepton parasiticum.—Arnaud, 1964: 55–60.
Neolepton parasiticum.—Osorio and Bahamonde, 1970: 221.
Neodavisia parasiticum.—Bernard, 1983: 33; Ramírez-Böhme, 1993: 136
Waldo parasiticus.—Nicol, 1966: 59–61, pl. 8, fig. 5 and pl. 9, figs. 5–7.

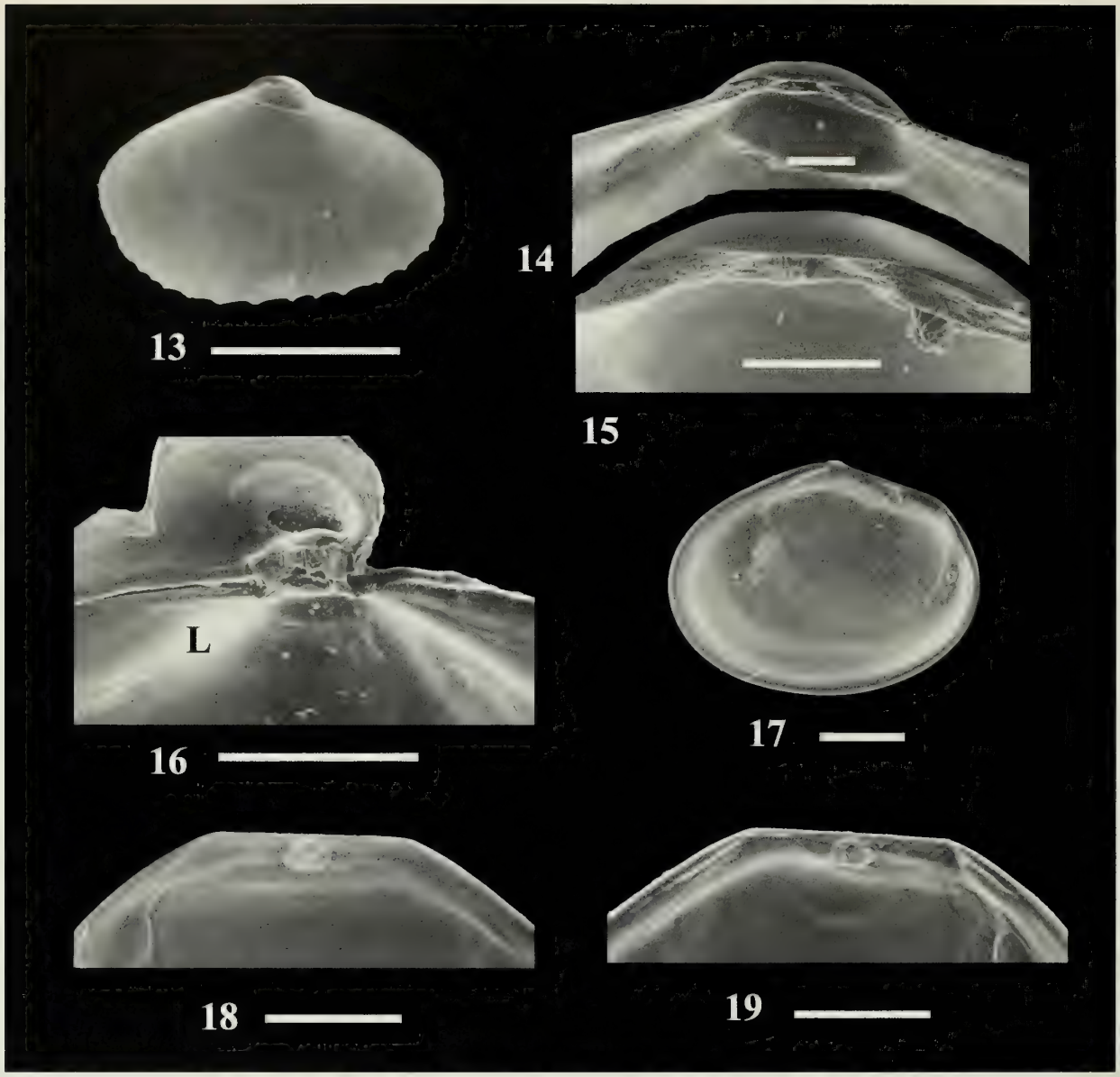
Description: Shell small (maximum shell length 4.1 mm), moderately inflated (mean shell width/shell height ratio 0.6 ± 0.06, n = 11). Shell extremely thin, whitish, translucent, shiny. Shell outline ovate, elongate (shell height/shell length ratio: 0.69 ± 0.04, n = 11), slightly inequilateral, beaks subcentral, not prominent (Figures 2–4). Anterior end rounded and slightly projecting, posterior end truncate (less markedly in juveniles), slightly oblique (Figures 4, 5). Dorsal margin straight or slightly and evenly arcuate, posterior margin straight, ventral margin slightly and evenly curved, crenulate. Valves gaping ventrally and at anterior and posterior ends (Figures 8–10). Nepionic shell (approximately 470 μm length), inflated, forming a rounded cup (Figure 11), clearly demarcated by a commarginal rim (Figure 12). Shell surface sculptured with 30–35 relatively well-marked radial ribs and irregular commarginal ribs, both fading towards the beaks. Radial ribs often very evident in small-sized specimens, tending to fade in adults. Hinge edentulous in adults. Ligament internal, strong; external periostracal ligament present (Figures 13–16).

D-shaped larvae with two well-developed lamellar lateral teeth in the right valve, the anterior long and slen-



Figures 2–3. *Waldo parasiticus*. Lectotype, USNM 11907. **2.** Right lateral view. **3.** Posterolateral view showing the exhalant siphon and the unpaired tentacle above the siphon. **f:** foot; **s:** siphon; **t:** tentacle. Scale bars = 1 mm.

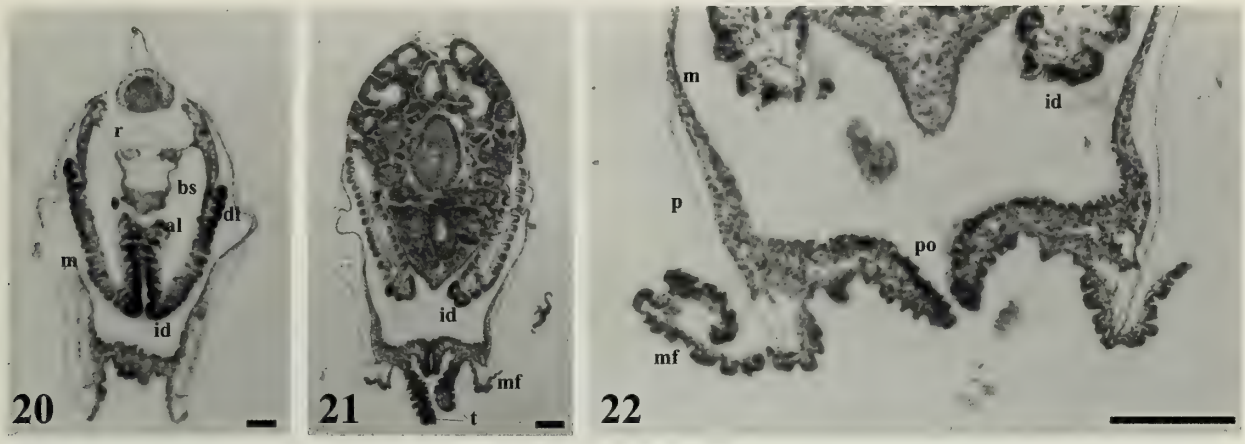
Figures 4–12. *Waldo parasiticus* from South Georgia Islands, MLP 6505. **4.** Outer view of an adult specimen. **5.** Outer view of a juvenile. **6.** Lateral view of a living specimen showing the anterior extention of the mantle border. **7.** Ventral view of a specimen showing the anterior mantle projections and paired tentacles along the ventral mantle border. **8.** Anterior shell gap. **9.** Ventral shell gap. **10.** Posterior shell gap. **11.** Detail of the nepionic shell. **12.** Detail of the zone between nepionic shell and dissoconch. Scale bars: Figures 4–10 = 1 mm; Figures 11–12 = 100 μm.



Figures 13–19. *Waldo parasiticus.* **13–15.** Isla de Los Estados, MACN 22219; **16–19.** South Georgia Islands, MLP 6505. **13.** Inner view of a left valve. **14, 15.** Details of the hinge. **16.** Inner view showing the internal ligament. **17.** Inner view of the right valve of a larva removed from adult. **18.** Right valve of a larva, detail of the hinge. **19.** Left valve of a larva, detail of the hinge. **L**: internal ligament. Scale bars: Figure 13 = 1 mm; Figures 14–15, 17–19 = 100 μm; Figure 16 = 500 μm.

der, the posterior shorter and stronger; in the left valve two slightly marked fossettes to receive right laterals. Larval ligament internal, strong, short, somewhat triangular (Figures 17–19).

Anatomy: Mantle margins free for about the ⅔ of its length, fused at posterior end forming a relatively short presiphonal suture. Only the exhalant aperture, extended in a short siphon, present (Figure 3). Mantle border extending beyond shell margin, covering the surface of the valves. The free edges of the mantle extend anteriorly and upwards forming a partly closed channel serving as a temporary inhalant "siphon" (Figures 6, 7). Ventral mantle border with long and stout cylindrical tentacles: 1 unpaired tentacle (just over the exhalant siphon) and 7 paired tentacles, alternate or opposite (5 pairs at sides of the pedal aperture, 1 at the point of mantle border fusion, and 1 posterior to the mantle border fusion, on the presiphonal suture) (Figures 3, 7). Only one, the inner, demibranch present, ascending lamella shorter than the descending one, with few interlamellar junctions; the suprabranchial space serves as brood space (Figures 20–22). Foot cylindrical (short when retracted) with a blunt heel and well-marked byssal groove running along the ventral foot surface. A strong byssal gland lo-



Figures 20–22. Histology of *Waldo parasiticus* (South Georgia Islands, MLP 6505). **20.** Transverse section at the posterior end of the visceral mass. **21.** Transverse section at the anterior half of the visceral mass. **22.** Detail of the free mantle border. **al**: ascending lamella of inner demibranch; **bs**: brooding space; **dl**: descending lamella of inner demibranch; **id**: inner demibranch; **m**: mantle; **mf**: expanded mantle fold; **p**: periostracum; **po**: pedal opening **r**: rectum; **t**: tentacle. Scale bars: 200 μm.

cated at the base of the heel secreting a byssus of 3 to 5 filaments.

Type Locality: Kerguelen Islands.

Material Examined: Lectotype (here designated) (Figures 2, 3) and numerous **paralectotypes** (>50 severely damaged specimens and loose valves) of *Lepton parasiticum* (USNM 11907); syntypes of *Montacuta christenseni* (BM 35268 and 35270) (mostly decalcified); numerous specimens from Deception Island, Bransfield Strait, South Shetland Islands (USNM 613095), and 54°18′ S, 35° 30′ W, South Georgia Islands, 94 m, 8 April 1996 (MLP 6505, MACN 35017); 2 specimens, South Georgia Islands (MACN 18715); several loose valves, Isla de los Estados (MACN 22219); 10 specimens, 54°27′ S, 35°41′ W, South Georgia Islands, 249–256 m, 12 April 2002 (MLP 6729); 4 specimens, 60°59′ S, 43° 27′ W, South Orkneys Islands, 399–402 m, 22 April 2002 (MLP 6731) (Figure 1).

Other Published Records: Southern Chile: 41°58′ S, 73°18′ W, Golfo de Ancud (200 m); 41°43′18″ S, 72°38′15″ W, Estero Reloncaví (470 m); 41°38′34″ S, 72°22′45″ W, Estero Reloncaví (50 m) (Soot-Ryen, 1959); Antarctica: Adelia Land (Arnaud, 1964) (Figure 1).

Distribution: Antarctic and Subantarctic waters, 50–470 m.

Remarks: Diagnostic characters of *Waldo parasiticus* are: the extremely thin shell, gaping ventrally and at anterior and posterior ends, beaks with a well-marked nepionic shell, adult hinge edentulous with internal ligament, shell surface sculptured with radial ribs and commarginal ribs, and expanded mantle border covering the outer shell surface bearing long and stout tentacles.

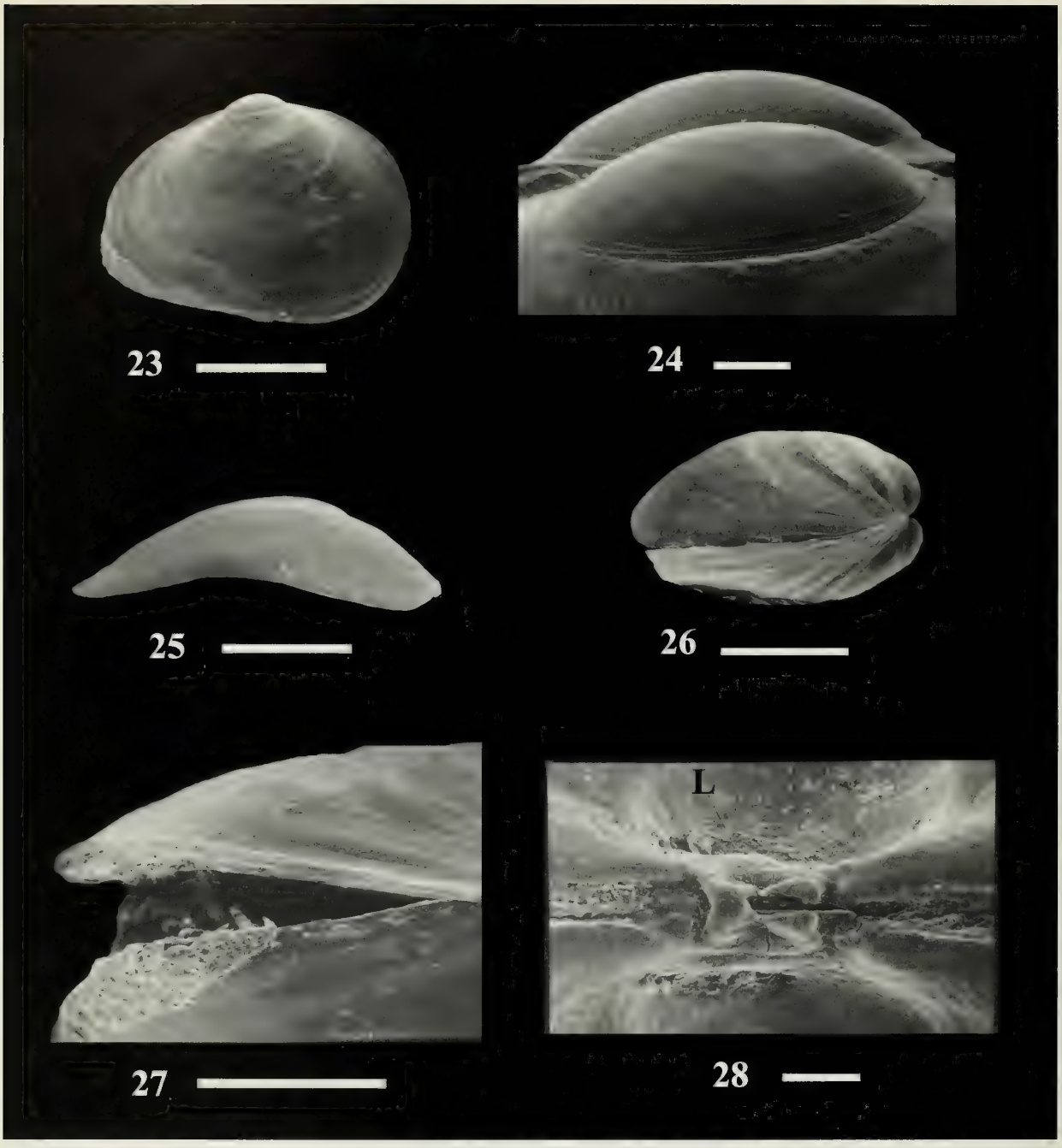
The syntypes of *Montacuta christenseni* (despite being strongly decalcified) were found to be identical in shell morphology and soft part anatomy to *Waldo parasiticus*. Smaller syntypes differed slightly in having strongly marked radial ribs.

The original description of *Lepton costulatum* Martens, 1885, and its redescription by Martens and Pfeffer (1886) are rather poor and lack illustrations. Despite this, they are informative enough to indicate that *L. costulatum* is conspecific with *W. parasiticus*. Unfortunately, the types of *L. costulatum*, originally housed at Museum für Naturkunde, Berlin (ZMB 37468), seem to be lost (M. Glaubrecht, in litt., June 2001).

Solecardia antarctica Hedley, 1911, a species reported from the Antarctic Region, is also similar to *W. parasiticus* and, based on the information given by the original description and figure, they seems to be conspecific, as previously suggested by Arnaud (1964).

Lepton costulatum and *Montacuta christenseni* were previously proposed as synonyms of *Lepton parasiticum* by Soot-Ryen (1959).

Biological observations: *Waldo parasiticus* is a dioecious species. Females produce large, non-planktotrophic yolky eggs, which are incubated in the space limited by the descending lamella of the inner demibranch and the visceral mass. Larvae, occurring free in the volume of the brooding space, were found in April and November in specimens larger than 1.5 mm. A maximum number of 157 D-shaped larvae (0.45/0.5 mm length × 0.4/0.5 mm width), all in the same developmental stage, were found in a maternal individual of 2.7 mm long. *Waldo parasiticus* lives as an epibiont, secured by the byssus to the spines in the ambulacral areas of numerous irregular Antarctic and circumantarctic Schizasteridae echinoids (Table 1). The epibiotic behavior in association with large invertebrates (referred to as symbiosis, commensalism or parasitism by different authors) is characteristic of many Galeommatoidea. While the



Figures 23–28. *Waldo trapezialis* new species. **23.** Holotype (MLP 6728-1), left lateral view. **24–28.** Paratypes (MLP 6728-2). **24.** Detail of the nepionic shell. **25.** Ventral view of a left valve showing ventral gap. **26.** Posterior view. **27.** Anterior end showing a portion of the mantle fold (much retracted) covering the shell. **28.** Detail of the hinge showing the internal ligament. **L**: internal ligament. Scale bars: Figures 23, 25, 26 = 1 mm; Figures 24, 28 = 100 μm; Figure 27 = 500 μm.

vast majority of galeommatids have been reported to live on crustaceans, members of the Montacutidae were mainly reported associated with irregular echinoids (Coan et al., 2000; Mikkelsen and Bieler, 1992; Ponder, 1968; Deroux, 1961; Popham, 1940).

Species erroneously identified as *Waldo parasiticus*: Mortensen (1943) reported specimens of "white mussels" attached to spines of the echinoid *Sterechinus diadema* from Kerguelen Islands; these specimens were later reported by Arnaud (1964) as *Notolepton parasiticum*. However, Mortensen's (1943) figures suggest that the specimens likely belong to *Lissarca notorcadensis* Melville and Standen, 1907.

Powell (1957) erroneously reported specimens of a true Neoleptonidae as *Notolepton parasiticum* (Dall). Speci-

Table 1. Echinoid species reported as hosts for *Waldo parasiticus*.

Species (original designations)	Host	Source
Lepton parasiticum	*Tripylus* sp.	Dall, 1876
Lepton costulatum	spatangoid echinoids	Martens, 1885; Martens and Pfeffer, 1886
Lepton sp.	*Abatus cavernosus*	Mortensen, 1910;
	Abatus agassizii	Mortensen, 1936
Lepton parasiticum	*Abatus cordatus*	Thiele, 1912
Montacuta christenseni	*Abatus cavernosus*	Grieg, 1929
Montacuta christenseni	*Abatus cavernosus*	Mortensen, 1936
Lepton cf. *parasiticum*	*Triphylaster philippii*	Soot-Ryen, 1959
Notolepton parasiticum	*Abatus bidens*	Arnaud, 1964
Waldo parasiticus	*Abatus agassizii*	present work
Waldo parasiticus	*Triphylus excavatus*	present work

mens reported and figured by Dell (1964) as *Neolepton parasiticum* (Dall) also correspond to a neoleptonid.

Waldo trapezialis new species
(Figures 23–28)

Description: Shell small (maximum shell length 2.9 mm), trapezoidal, somewhat inflated (shell width/shell height ratio: 0.73 ± 0.12, n = 7), relatively high (shell height/shell length ratio: 0.74 ± 0.03, n = 7); gapping widely at ventral margin and only slightly at anterior end (Figures 25, 27). Shell extremely thin, white, shiny. Shell inequilateral, slightly inequivalve (Figure 26). Beaks subcentral, slightly displaced forward (located at around 45% of shell length), not prominent (Figure 23). Nepionic shell (approximately 590 μm length) well-marked, inflated, forming a cup (Figure 24). Anterior end low, widely rounded, posterior end high, evenly arcuate. Dorsal margin markedly sloping forward, wide and evenly arcuate, ventral margin long, straight and smooth. Shell surface smooth. Hinge edentulous in adults. Internal ligament, strong, saddle-shaped (Figure 28), external periostracal ligament present.

Anatomy: Mantle margins free at about the 3/4 of its length, with large pedal aperture; posterior end of the mantle forming an exhalant aperture extended in a short siphon. Mantle border extended beyond the shell margin, covering at least partially the shell surface. At the anterior end, the free edges of the mantle extend to form a temporary inhalant structure, a partly closed channel directed upwards. Along the ventral border of the mantle 5 pairs of opposite long and stout cylindrical tentacles, present: 3 at sides of the pedal aperture, 1 at the point of mantle fusion, and 1 posterior to the fusion, on the presiphonal suture. Only one, the inner, demibranch present. Foot cylindrical with a blunt heel and well-marked bysal groove running along its ventral surface. A strong byssus gland located at the base of the foot heel secretes a multifilamentous byssus; each one of the byssus filaments provides anchorage to one spine of the host, an irregular echinoid.

Type locality: 54°18′ S, 35°30′ W, South Georgia Islands, 94 m (Figure 1).

Type material: Holotype (MLP 6728–1) (2.45 × 1.9 mm), 3 paratypes (MACN 35016) (2.9 × 2.0 mm, 1.7 × 1.35 mm and 1.6 × 1.25 mm) and 2 paratypes (MLP 6728–2) (2.45 × 1.8 mm and 2.9 × 2.2 mm) all from type locality, 8 April 1996; 1 paratype, 54°27′ S, 35°41′ W, South Georgia Islands, 249–256 m, 12 April 2002 (2.55 × 1.8 mm) (MLP 6730).

Distribution: South Georgia Islands.

Etymology: The name refers to the trapezoidal shell outline.

Remarks: *Waldo trapezialis* new species can be easily identified by its trapezoidal shell shape, smooth shell surface, and shell border not crenulated. *W. trapezialis* differs from *W. parasiticus* in having a more inflated, slightly inequivalve shell, with a long smooth and straight ventral margin, high broadly arcuate posterior end, and surface without radial sculpture or commarginal ribs. The nepionic shell is larger in *W. trapezialis*. *W. trapezialis* also differs from *W. parasiticus* in lacking the unpaired tentacle above the exhalant siphon.

The specimens of *Waldo trapezialis* new species studied were collected attached to loose spines of an irregular echinoid. We do not have at this point further details on the identification of the host species.

THE SYSTEMATIC POSITION OF *WALDO*

The genus *Waldo* was proposed by Nicol (1966) to include *Lepton parasiticum* Dall, and was tentatively assigned to the family Neoleptonidae. The presence of only one pair of demibranchs clearly exclude *Waldo* from the Neoleptonidae. Salas and Gofas (1998), in a revision of the genus *Neolepton*, suggested that *Waldo parasiticus* most likely belongs to the Montacutidae or Galeommatidae. However, the lack of hinge teeth in the adults, the presence of stout tentacles as mantle projections, and the dioecious condition are characters not previously reported for members of the Montacutidae. At

present there is not agreement on the suprageneric classification of the Galeommatoidea. Vokes (1980) recognized five families of Galeommatoidea: Kellidae, Erycinidae, Leptonidae, Montacutidae and Galeommatidae, while Coan et al. (2000), recognized only two galeommatoid families: Lasaeidae (which includes Montacutidae) and Galeommatidae. Due to this and to the lack of a clear definition of families, a decision about the suprageneric placement of *Waldo* is postponed.

Waldo parasiticus resembles *Scioberetia australis* F. Bernard, 1895, a species obtained from the ambulacral areas of the echinoid *Tripylus excavatus* from Cape Horn (southern South America). The species was never recorded again after its original description; however, Bernard's (1895a) record was subsequently repeated by Thiele (1912), Arnaud (1964), Osorio and Bahamonde (1970), F. R. Bernard (1983), and Böhme (1993). According to the generic diagnosis of the genus *Scioberetia* given by Thiele (1934), *Waldo* would be its synonym. However, from Bernard's (1895a) original description and from the study of the type material of *S. australis* (MNHN), it is clear that this genus differs from *Waldo* by the presence of a well-developed taxodont-like larval hinge teeth (Bernard, 1895a), the lack of byssus gland and by the absence of tentacles on the mantle border. The probable hermaphroditic condition discussed by Bernard (1895a–c) would be an additional differential character. In our opinion, both *Scioberetia* and *Waldo* should be considered as valid genera.

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LITERATURE CITED

Arnaud, P. 1964. Echinodermes littoraux de Terre Adélie (Holothuries exceptées) et Pélécypodes commensaux d'echinides antarctiques. Expeditions Polaires Francaises (Mission Paul-Emile Victor), Publication 258, 69 pp.

Bernard, F. 1895a. Sur un lamellibranche nouveau (*Scioberetia australis*) commensal d'un Échinoderme. Comptes Rendues de l'Academie des Sciences 121 (17): 569–571.

Bernard, F. 1895b. *Scioberetia australis*, type nouveau de lamellibranche. Bulletin Scientifique de la France et la Belgique 27: 364–395.

Bernard, F. 1895c. Sur quelques stades du développement du *Scioberetia australis nob.*, lamellibranche à coquille interne. Bulletin du Muséum d' Histoire Naturelle 1(7): 275–277.

Bernard, F. R. 1983. Catalogue of the living Bivalvia of the Eastern Pacific Ocean: Bering Strait to Cape Horn. Canadian Special Publications of Fisheries and Aquatic Sciences 61: 1–102.

Coan, E. V., P. V. Scott and F. R. Bernard. 2000. Bivalve seashells of Western North America. Santa Barbara Museum of Natural History Monographs number 2, Studies in Biodiversity 2, 764 pp.

Dall, W. H. 1876. Contributions to the Natural History of Kerguelen Island, II. Mollusks. Bulletin of the United States National Museum 3: 42–48.

Dell, R. K. 1964. Antarctic and sub-Antarctic Mollusca: Amphineura, Scaphopoda and Bivalvia. Discovery Reports 33: 93–250.

Dell, R. K. 1990. Antarctic Mollusca with special reference to the fauna of the Ross Sea. Bulletin of The Royal Society of New Zealand 27: 1–311.

Deroux, G. 1961. Rapports taxonomiques d'un Leptonacé non décrit *"Lepton subtrigonum"* Jeffreys (*nomen nudum* – 1873). Cahiers de Biologie Marine 2: 99–153.

Gabe, M. 1968. Techniques histologiques. Masson, Paris. 1113 pp.

Grieg, J. 1929. Echinodermata from the Palmer Archipelago, South Shetlands, South Georgia and the Bouvet Island. Scientific Reports of the Norwegian Antarctic Expedition 1927–1929, 1(2): 1–16.

Linse, K. 1997. Distribution of epibenthic Mollusca from the Chilean Beagle Channel. Berichte zur Polarforschung 228: 1–130.

Martens, E. 1885. Volaufine Mitheilungen über die Molluskenfauna von Süd Georgien. Sitzungs-Berichte der Gesellschaft Naturforschender Freunde zu Berlin: 89–94.

Martens, E. and G. Pfeffer. 1886. Die mollusken von Süd-Georgien nach der Ausbeute der Deutschen Station 1882–83. Jarhbuch der Hamburgischen Wissenschatlichen Anstalten 3: 66–135.

Mikkelsen, P. M. and R. Bieler. 1992. Biology and comparative anatomy of three new species of commensal Galeommatidae, with a possible case of mating behaviour in bivalves. Malacologia 34 (1–2): 1–24.

Mortensen, T. 1910. The equinoidea of the Swedish South Polar Expedition. Wissenschaftliche Ergebnisse der Schwedichen Südpolar Expedition 1901–1903. Band 6, Zoology 2: 114 pp + 19 plates.

Mortensen, T. 1936. Echinoidea and Ophiuroidea. Discovery Reports 12: 199–348 + 9 plates.

Mortensen, T. 1943. A monograph of the Echinoidea. III. 3. Camarodonta II. Echinidae, Strongylocentrotidae, Parasaleniidae, Echinometridae. C.A. Reitzel, Copenhagen, 440 pp.

Mühlenhard-Siegel, U. 1989. Antarktische Bivalvia der Reisen des F.S. "Polarstern" und des F.F.S. "Walther Herwig" aus den Jahren 1984 bis 1986. Mitteilungen aus dem Ham-

burgischen Zoologischen Museum und Institut 86: 153–178.

Nicol, N. 1966. Description, ecology and geographic distribution of some Antarctic pelecypods. Bulletin of American Palaeontology 51(231): 1–102.

Osorio, C. and N. Bahamonde. 1970. Lista preliminar de los lamelibranquios de Chile. Boletín del Museo Nacional de Historia Natural 31: 185–256.

Ponder, W. F. 1968. Three commensal bivalves from New Zealand. Records of the Dominion Museum 6(9): 125–131.

Popham, M. L. 1940. The mantle cavity of some of the Erycinidae, Montacutidae and Galeommatidae with special reference to the ciliary mechanisms. Journal of the Marine Biological Association of the United Kingdom 24: 549–586.

Powell, A. W. B. 1957. Mollusca of Kerguelen and Macquerie islands. B.A.N.Z.A.R.E. Reports, B 4(10): 107–150.

Ramírez-Böhme, J. 1993. Moluscos de Chile. Bivalvia. Vol. 4, Tomo 1. 144 pp. Author's edition.

Salas, C. and S. Gofas. 1998. Description of four new species of *Neolepton* Monterosato, 1875 (Mollusca: Bivalvia: Neoleptonidae), with comments on the genus and on its affinity with the Veneracea. Ophelia 48 (1) 35–70.

Soot-Ryen, T. 1959. Reports of the Lund University Chile Expedition 1948–49. 35. Pelecypoda. Acta Universitatis Lundensis Avd. 2 Bd. 55 Nr 6: 1–85 + 4 pl.

Thiele, J. 1912. Die Antarktischen Schnecken und Muscheln. Deutsche Südpolar Expedition 1901–1903, 13:183–285.

Thiele, J. 1934. Handbuch der systematischen Weichtierkunde. Gustav Fischer Verlag, Jena. Bd 2, Dritter Teil, pp. I-V, 779–1022.

Vokes, H. 1980. Genera of the Bivalvia: a systematic and bibliographic catalogue (revised and updated). Paleontological Research Institution. Ithaca, New York, USA. 307 pp.

The status and identity of *Papyridea soleniformis* (Bruguière, 1789) (Bivalvia: Cardiidae)

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ABSTRACT

The name *Papyridea soleniformis* (Bruguière, 1789), as used by most authors, embraces two taxa of marine cardiids found in the tropical Atlantic Ocean. *Papyridea lata* (Born, 1778) occurs in the western Atlantic Ocean, Caribbean Sea, and Gulf of Mexico. Born's specimen in the Zoologisches Museum, Vienna, labeled as variety "*roseo-maculata*" (891a), is here designated as the lectotype. *Papyridea soleniformis* (Bruguière, 1789) is sympatric with *P. lata*, but also occurs in the eastern Atlantic Ocean. Chemnitz, 1782, *Conchylien Cabinet*, page 65, plate 6, figures 49 and 50 are designated as the lectotype illustrations. *Cardium (Papyridea) spinosum* var. *turtoni* Dall, 1900 is a junior synonym of *P. soleniformis*.

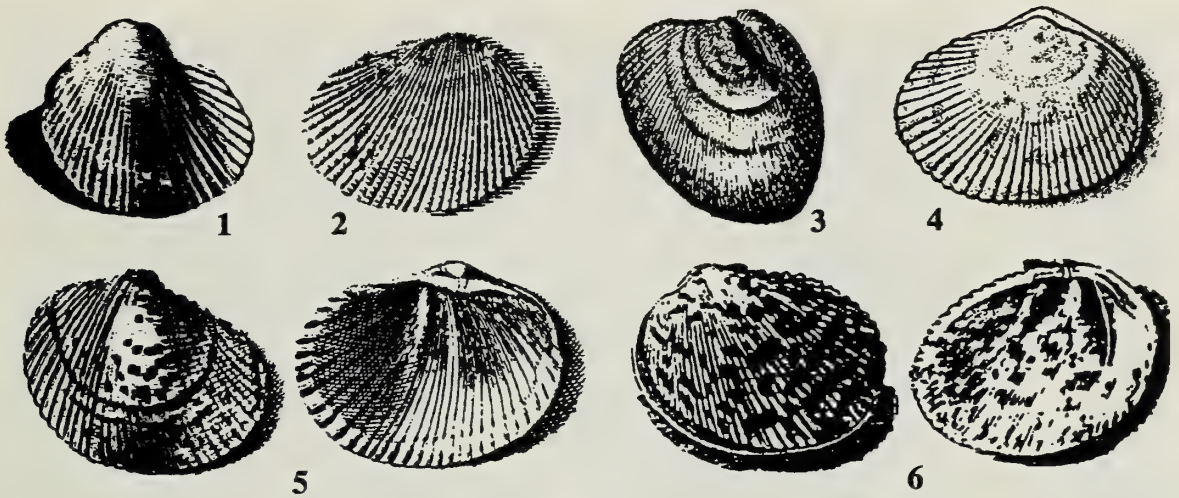
Additional key words: Cardioidea, type specimen, Atlantic Ocean.

INTRODUCTION

The marine cardiid known as *Papyridea soleniformis* (Bruguière, 1789) is considered a fairly common, widespread species in the western Atlantic Ocean, Caribbean Sea, and portions of the eastern Atlantic Ocean. Additional study has revealed the presence of two taxa currently grouped under that name: *Papyridea soleniformis* (Bruguière, 1789) and *Papyridea lata* (Born, 1778). The source of the taxonomic confusion concerning these species may be traced to Linnaeus (1758). He described *Solen bullatus* from an unknown locale with reference to Rumphius's plate 44, fig. N (Figure 1). However, Linneaus's brief description of *Solen bullatus* does not apply to this illustration. (I have cited Rumphius (1705) for this figure, but as Dodge (1952) pointed out, we cannot be sure which edition, or even which of Rumphius's two works, *Amboinische Rariteitkamer* or *Thesaurus imaginum piscium Testaceorum*, was involved. Regardless, the plates of the two works are identical.) The species depicted in Rumphius's fig. N also does not conform to Linnaeus's concept of *Solen* as evidenced by the other species originally included by him in that genus. Smith (1945) identified the figure with a Pacific species of *Fulvia*. But the color plate in Rumphius is of an all-white shell, which would be rare for a *Fulvia*. Furthermore, Rumphius used the vernacular name Doublet or Dubbeld for other cardiids and the name Ark for arcids. Rumphius called the species later named by Linnaeus as the Bastaard Ark. Based on this evidence, Rumphius's species undoubtedly is an arcid. Schumacher (1817) believed Linnaeus's species was misplaced in *Solen* and suggested *Coeur* (a cardiid). Hanley (1855) agreed but suggested that the description applied to a *Fulvia* and the illustration to an arcid. Dodge (1952) concluded that Linnaeus mistakenly had given Rumphius's fig. N as representing this species. In any event, the species cannot be identified unambiguously from either the description or the illustration and no type exists in the Linnean collection (Dodge, 1952). The name *Solen bullatus* therefore is a *nomen dubium*. However, many subsequent authors retained *bullatus* for various species and ignored Linnaeus's incongruous description. Inasmuch as we do not know the identity of Linnaeus's species, no use of the name *Solen bullatus* can be accepted as a correct identification, and none of the subsequent authors may be considered the author of that name, even if placed in a different genus (ICZN, 1999: Art. 49). Finally, Rumphius's fig. N does not resemble either of the two *Papyridea* species discussed here and appears to be an arcid.

MATERIALS AND METHODS

Fifty-six specimens of *P. soleniformis* and 325 specimens of *P. lata* were examined. Specimens were measured as the greatest length parallel to the hinge axis. Institutional acronyms are: ANSP, Academy of Natural Sciences, Philadelphia, USA; GTW, collection of G. Thomas Watters, Columbus, Ohio, USA; HGL, collection of Harry G. Lee, Jacksonville, Florida, USA; RV, collection of Ron Voskuil, Delft, The Netherlands; UF = Florida Museum of Natural History, Gainesville, Florida, USA; UMMZ = University of Michigan Museum of Zoology, Ann Arbor,



Figures 1–6. **1.** Rumphius, 1705, pl. 44, fig. N. Type figure of *Solen bullatus* Linnaeus, 1758. **2.** *Pectunculus tenuis pellucidus*. . . Lister, 1685, pl. 342, fig. 179. Type figure of *Coeur spinosum* Meuschen, 1787 = *Papyridea lata* (Born, 1778). **3.** *Blasenarrige Herz* Knorr, 1772, pl. 7, fig. 6. Cited by Born as questionable figure of *Cardium latum* Born, 1778. **4.** Born, 1780, pl. 3, fig. 8. Born's refiguring of *Cardium latum* Born, 1778. **5.** *Chama H. inaequilatera, oblique striata*. . . Gualtieri, 1742, pl. 85, fig. H. Type figure of *Coeur hiatus* Meuschen, 1787 = *Papyridea soleniformis* (Bruguière, 1789). **6.** *Solen bullatus* "Linnaeus." Chemnitz, 1782, 65, pl. 6, figs. 49, 50. Lectotype figure of *Cardium soleniforme* Bruguière, 1789, designated herein.

Michigan, USA; USNM = National Museum of Natural History, Washington, DC, USA.

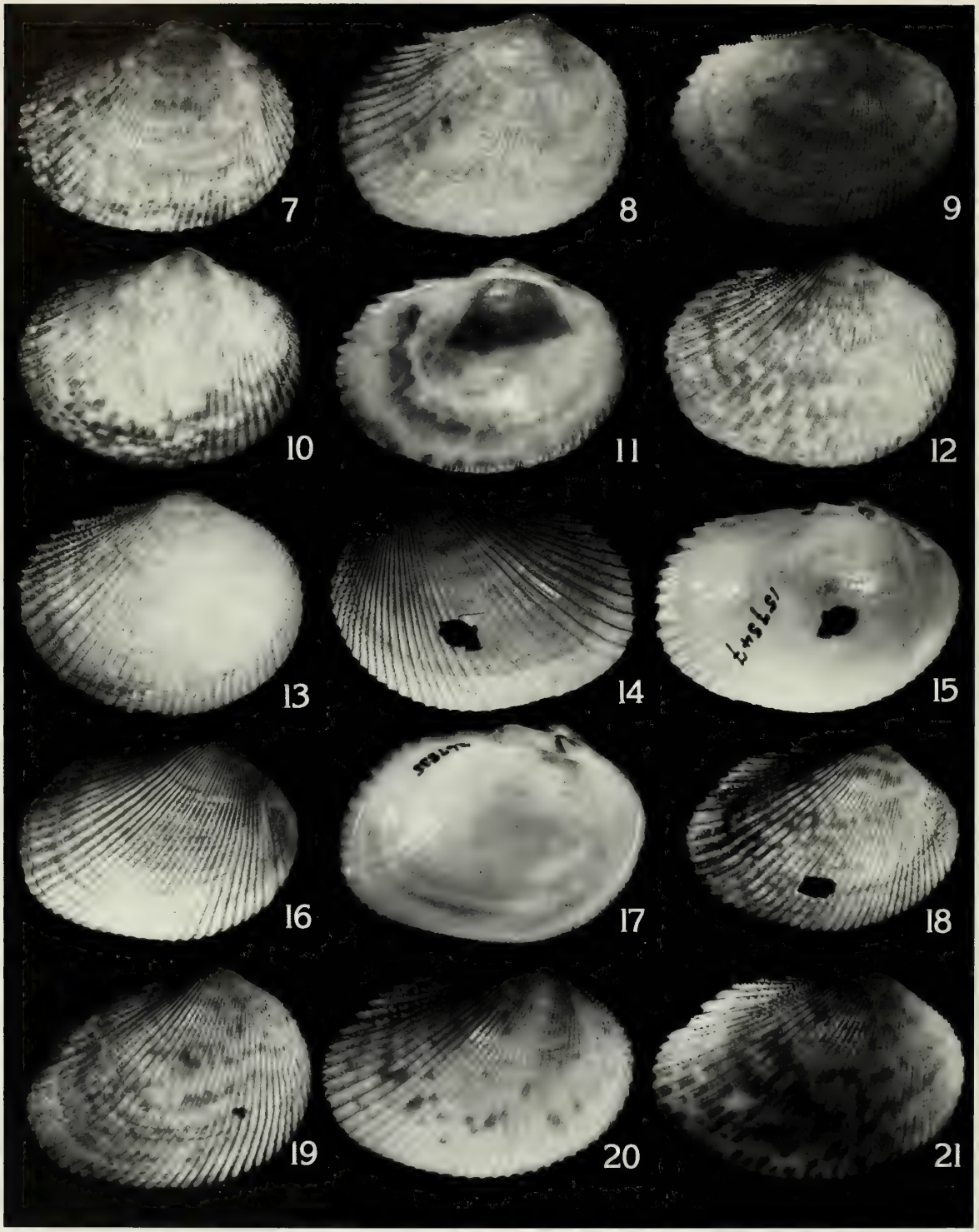
SYSTEMATICS

Superfamily Cardioidea Lamarck, 1809
Family Cardiidae Lamarck, 1809
Subfamily Trachycardiinae Stewart, 1930
Genus *Papyridea* Swainson, 1840

Type Species: *Papyridea Soleniforme* "Wood," *non* Bruguière, 1789, by subsequent designation of Gray (November, 1847). Swainson had included four species under *Papyridea,* including *Papyridea soleniforme* "Wood, 1815." Wood's figure (pl. 56, fig. 3) is of *Papyridea lata* (Born, 1778). Swainson's type species is therefore misidentified. But as both species are members of *Papyridea,* there is no threat to the stability of this genus name, and I have not referred the case to the Commission (ICZN, 1999: Art. 70 (b)). Herrmannsen (September, 1847) had earlier designated *Cardium bullatum* as type of *Papyridea,* but as that species was not included by Swainson in his original list, it is not eligible as the type species.

Papyridea lata (Born, 1778)
(Figures 2, 4, 7–13)

Pectunculus tenuis pellucidus, leviter purpurascens, dense striatus a Jamaica Lister, 1685: pl. 342, fig. 179 [pre-Linnean; type figure of *Coeur spinosum* Meuschen, 1787, by restriction of Clench and Smith, 1944, as first revisors].
Cardium latum Born, 1778: 37; 1780: pl. 3, fig. 9; Bruguière, 1789: 234–235 [*partim*].
Coeur spinosum Meuschen, 1787: 442 [non-binomial].
Cardium soleniforme "Bruguière".—Wood, 1815: 233, pl. 56, fig. 3; 1835:56, fig. 3; 1856: 5, pl. 5, fig. 36 [all *non* Bruguière, 1789].
Papyridea Soleniforme "Wood".—Swainson, 1840: 374.
Cardium (Papyridea) bullatum (Linnaeus).—Römer, 1869: 74–76, pl. 12, figs. 13–16.
Cardium latum "Chemnitz".—Brauer, 1878: 127.
Cardium (Papyridea) bullatum "Chemnitz".—Kobelt, 1880: 345, pl. 101, fig. 4.
Cardium spinosum var. *spinosum* (Meuschen).—Dall, 1900b: 1107–1108.
Papyridea spinosum (Meuschen).—Smith, 1937: 49, pl. 17, fig. 8; McLean, 1939: 164–165, pl. 24, figs. 3, 9; Vilas and Vilas, 1945: 38, pl. 3, fig. 15.
Papyridea hiatus (Meuschen).—Clench and Smith, 1944: 17, pl. 4, figs. 3–5 [*partim*].
Papyridea hiatus (Meuschen).—McLean, 1951: 71 [*partim*] [not pl. 15, fig. 1 = *Papyridea soleniformis* (Bruguière, 1789)].
Papyridea soleniformis (Bruguière).—Keen, 1937: 14–15; Abbott, 1954: 398, pl. 39n [*partim*]; Perry and Schwengel, 1955: 68, pl. 13, fig. 74; Warmke and Abbott, 1961: 183, pl. 37j; Abbott, 1968: 228, fig. 7; Nordsieck, 1969: 103, pl. 15, fig. 57.10; Stanley, 1970: 157, 158, pl. 20, figs. 1–6; Porter and Tyler, 1971: 16, fig. 9; Clench, 1973: 57, pl. 23, fig. 16; [*partim*] Abbott, 1974:484, pl. 22, fig. 5555; Humfrey, 1975: 245, pl. 29, figs. 18, 18a.; Rios, 1975: 223, pl. 71, fig. 1072; Keen, 1980: pl. 5, fig. 7 [*partim*]; Vokes and Vokes, 1983: 40, 63, pl. 41, fig. 5; Rios, 1994: 263, pl. 90, fig. 1282 [all *non* Bruguière, 1789].
Cardium bullatum "Chemnitz".—Lamy, 1941: 462–463 [*partim*].
Papyridea (Papyridea) soleniforme (Bruguière).—Fischer-Piette, 1977: 69–70 [*partim*].
Papyridea latum (Born).—Voskuil and Onverwagt, 1991: 31 [*partim*].
Papyridea (Papyridea) lata (Born).—Kafanov, 1997: 3–4, pl. 1, figs. 3a, b, pl. 2, figs. 1a–d, 2a–e, pl. 3, figs. 1a–c.



Figures 7–13. *Papyridea lata* (Born, 1778). **7.** Lectotype, herein designated (Zoologisches Museum, Wien, 891a) (from original photograph of R. Voskuil). Locality unknown. **8.** Paralectotype, herein designated (Zoologisches Museum, Wien, 891a) (from original photograph of R. Voskuil). Locality unknown. **9.** 2–12 m, Cat Cay, Bimini, Bahamas (UF 176315) (47 mm). **10–11.** Beached, Sanibel Island, Florida, USA (GTW) (34 mm). **12.** Salvador, Bahía State, Brasil (HGL) (36 mm). **13.** Matanzas, Cuba (GTW) (31 mm).

Figures 14–21. *Papyridea soleniformis* (Bruguière, 1789). **14–15.** Syntype of *Cardium (Papyridea) spinosum* var. *turtoni* Dall, 1900. [Pleistocene] of Caloosahatchee River, Florida, USA (USNM [USGS] 157547) (42 mm). **16–17.** Sao Tomé (ANSP 267835) (53 mm). **18.** St. Helena (USNM 777907) (43 mm). **19.** Cape Verde Islands (ANSP 309062) (45 mm). **20.** Water Island, Virgin Islands (GTW) (33 mm). **21.** Off Lake Worth, Florida, USA, 60 m (UF 12117) (34 mm).

Description: Shell to 44 mm in length, thin but solid, oval, compressed, slightly opisthogyrate, slightly inequilateral, with the umbo located 37–45% length back from the anterior margin. Posterior of umbones rounded, lacking a ridge or angulation. Shells gaping antero-ventrally and postero-dorsally, forming pedal and siphonal gapes respectively. Exterior of shell ornamented with 43–59 primary radial ribs. Ribs about as wide as interrib spaces on anterior of shell, becoming wider on posterior. Postero-dorsal margin dentate. Primary ribs triangular in cross-section on anterior of shell, becoming flattened on posterior of shell. Anterior-most primary ~18 ribs and posterior-most ~12 ribs ornamented with minute concave scales. Scales cross entire rib on anterior ribs, but are situated on a narrow medial line on the posterior ribs. Exterior color quite variable. Background white with large irregular patches of yellow, orange, rose, or purple, sometimes forming irregular concentric bands. Occasional specimens are uniformly colored with these shades. Some specimens have one or two vague, broad rays radiating from the umbones of the same color as the patches. These rarely persist on the exterior on specimens larger than 10 mm. Living and freshly dead specimens have a thin, tan-colored periostracum around the shell margin. Hinge occupying 1/2 of total length. Anterior laterals larger, more blade-like than posterior ones. Left and right laterals of equal size. Left laterals engage dorsal to right laterals. Small, peg-like left cardinal tooth fits into socket in right valve. Ligament external, small, approximately 1/6 or less of shell length. The arrangement of the teeth and ligament allows the shells to rock along an antero-postero axis (Watters, 1992). Interior of shell white, with exterior colors showing through. The two broad rays radiating from the umbo are much more conspicuous and noticeably longer on the interior than on the exterior.
Preserved examples have not been seen.

Type Material: The Born collection in the Zoologisches Museum, Wien, has two syntypes of *Cardium latum* (891a), one labeled *"roseo-maculata,"* the other *"luteo-maculata"* (Voskuil, in litt.). The first, *"roseo-maculata,"* corresponds best to Born's 1780 illustration and is here designated as the lectotype (Figure 7). The second specimen, *"luteo-maculata,"* is a paralectotype (Figure 8). ICZN (1999: Art. 72.4.1) does not allow specimens "expressly" excluded as distinct variants to remain part of the type series. Strictly speaking this might exclude Born's two color variants from being primary types. However, it is clear that Born considered all of his specimens to belong to one or the other color variant; the two variants therefore compose the entire type series.

Type locality: *Cardium latum* Born, 1778: unknown.

Material examined: BERMUDA: 1.5–3.0 m, Coney Island (GTW, HGL). TEXAS: 46 m off Freeport (ANSP). SOUTH CAROLINA: Myrtle Beach, Orry Co. (GTW). FLORIDA [Atlantic Ocean]: dredged 90 m (RV); 21 m, 121 km E of St. Augustine, St. Johns Co. (UF); 320 m, off St. Augustine, St. Johns Co. (GTW); 23 km ENE of Mayport, Duval Co. (HGL); 27 m, 32 km E of Mayport, Duval Co. (HGL); 30–60 m, off Singers Id., Palm Beach Co. (UF); 30 m, Peanut Island, Palm Beach Co. (UF); Palm Beach, Palm Beach Co. (UF); Fish Haven, Lake Worth, Palm Beach Co. (UF); Lake Worth, Palm Beach Co. (ANSP, GTW, UF); S of Lake Worth Inlet, Palm Beach Co. (UF); 55 m, off Boynton Inlet, Palm Beach Co. (UF); 18 m, off Briny Breezes, Palm Beach Co. (UF); fill from 18 m, Pompano Beach, Broward Co. (UF); Finger Channels, Dade Co. (HGL); Bear Cut, Key Biscayne, Dade Co. (UF); Biscayne Bay, Dade Co. (GTW); 73 m, off Miami, Dade Co. (GTW); Little Duck Key, Monroe Co. (UF); W end Bahia Honda Key, Monroe Co. (UMMZ); Newfound Harbor Keys, Monroe Co. (UF); 117 m, Florida Straits, 24°23'15" N, 82°01'17" W (UF). [Gulf of Mexico]: 64 m, 150° off Pensacola, Escambia Co. (UF); off Destin, Okaloosa Co. (ANSP); 26 m, Destin, Okaloosa Co. (UF); 40 m, 225° off Panama City, Bay Co. (ANSP, UF); 8–11 km S of Alligator Point, Franklin Co. (UF); Boca Ciega Beach, Pinellas Co. (UF); St. Petersburg, Hillsborough Co. (UF); Longboat Key, Sarasota Co. (UF); 13–15 m, 15–18 km SW of Big Sarasota Pass, Sarasota Co. (UF); Ft. Myers Beach, Lee Co. (ANSP); Captiva Island, Lee Co. (UF); Point Ybel, Sanibel Id., Lee Co. (UF); Sanibel Id., Lee Co. (ANSP, GTW, UF); Boca Grande, Gasparilla Island, Lee Co. (ANSP); Little Gasparilla Island, Lee Co. (ANSP); 55 m, off Naples, Collier Co. (UF); Naples Beach, Collier Co. (GTW); Marco Id., Collier Co. (UF); 427 m, 241 km W of Cape Romano, Collier Co. (UF); Madiera/Pass-a-Grille Beach, Pinellas Co. (UF, UMMZ); dredged 30 m, Bradenton, Manatee Co. (RV); off Panama City, Bay Co. (HGL). BAHAMAS: 2–11 m, Cat Cay, Bimini (UF); Alicetown, Bimini (ANSP); drift, 300 m N of Current Cut, Current, Eleuthera (HGL); Parrot Cays, Great Abaco (ANSP); Hog Island (ANSP). CUBA: (GTW); Matanzas (GTW); Playa del Frances (GTW); Varadero (ANSP, GTW); 5–7m, 0.8 km out from bay side of Icacos Peninsula (ANSP); Tarallones de Arena, near Santiago (ANSP). PUERTO RICO: (GTW); off Cabo Rojo Lighthouse (UF); Mayaguez (GTW); Punta Arenas (ANSP). VIRGIN ISLANDS: Devils Bay, Virgin Gorda (UF); St. Croix (UF); Water Id. (GTW); St. Thomas (ANSP). ST. MARTIN: (ANSP). GRENADA: 1 m, near Lance aux Epines (HGL); Grand Anse Beach (ANSP); 7–11 m, entrance of St. George Harbour (ANSP); 0.3–1 m, Prickly Bay (ANSP). MARTINIQUE: (ANSP, UF, UMMZ). ARUBA: (GTW). HONDURAS: 8 m, ESE of Punta Negro (ANSP); 8 m, N of Man of War Cay (ANSP); Hopkins, Commerce Bight (ANSP). BRAZIL: 3–6 m, off Clube Iate, Salvador, Bahia State (HGL); 1–3 m, Salvador, Bahia State (HGL); 9–10 m, Porto Belo, Santa Catarina State (HGL).

Distribution: Subtidal to at least 90 m. Western Atlantic Ocean from South Carolina to southern Brazil, Gulf of Mexico, Yucatan (Vokes and Vokes, 1983), Ber-

muda, and Caribbean Sea. Not recorded from the eastern Atlantic Ocean.

Remarks: Lister's (1685) figure 179 and description of the shell as "slightly purple" identifies it as *Papyridea lata* as no purple *P. soleniformis* are known to the writer. The rib count of the illustrated specimen is at the minimum for *P. soleniformis*, but only three less than the minimum for *P. lata*. Reliance on accurate rib counts for identification from a 17th century picture book may be unrealistic. The color pattern also suggests *P. lata* more so than *P. soleniformis*. This is the first mention of this species in the literature (Figure 2). Meuschen (1787) listed this taxon under the name *"Coeur spinosum,"* based on this figure and that of Knorr (1772), but Meuschen's work is non-binominal. Knorr (1772) illustrated a shell that may refer to one of the two taxa discussed here, but the figure is too crude for accurate identification (Figure 3). Knorr's works also are non-binominal. Born (1778) cited Knorr's 1772 illustration, but did so with a question mark, in describing specimens in the collection of the Empress Maria Theresa as *Cardium latum*. Born redescribed this species with his own figure in 1780 (Figure 4). This was the first available name for this species: *Cardium latum* Born, 1778. Voskuil and Onverwagt (1991) and Kafanov (1997) also reached this conclusion, but included both *P. lata* and *P. soleniformis* under that name. Finally, Brauer (1878), working with Born's types, identified *latum* with Meuschen's *spinosum*.

Papyridea lata differs conchologically from *P. soleniformis* in several ways. The former is noticeably more equilateral and lacks the angulation on the umbones. The ribs on the posterior half of the shell of *P. lata* are flattened, while those of *P. soleniformis* are triangular. The scales on the posterior primary ribs are positioned in a narrow medial band in *P. lata*, but in *P. soleniformis*, they are situated on the postero-dorsal slope of the ribs. The consistent color pattern of *P. soleniformis* is rarely duplicated in the much more variable and brightly colored *P. lata*. *Papyridea soleniformis* grows to a larger size than *P. lata*.

Papyridea soleniformis (Bruguière, 1789)
(Figures 5, 6, 14–21)

Chama H. inaequilatera, oblique striata, margine interno dentata, ex candido and roseo variegata and fasciata Gualtieri, 1742: pl. 85, fig. H [pre-Linnean; type figure of *"Coeur hiatus"* Meuschen, 1787, by original designation].

Solen bullatus Linnaeus.—Chemnitz, 1782: 66, pl. 6, figs. 49, 50 [rejected work; type figure of *Cardium soleniforme* Bruguière, 1789, herein selected] [reproduced Richardson, Abbott and Davis, 1979]; Gmelin, 1791: 3226; Bosc, 1802:13; Dillwyn, 1817: 69 [all *non* Linnaeus, 1758].

Coeur hiatus Meuschen, 1787: 442 [non-binominal].

Cardium soleniforme Bruguière, 1789: 235; Bosc, 1802:107.

Cardium bullatum (Linnaeus).—Lamarck, 1819: 6; Anton, 1839: 11; Sowerby, 1841: 2; Reeve, 1845: pl. 2, fig. 8; Reibisch, 1865: 126 [all *non* Linnaeus, 1758].

Cardium bullatum "Lamarck".—Dunker, 1853: 51.

Papyridea spinosa (Meuschen).—Adams and Adams, 1858: 456.

Papyridea (Fulvia) bullata (Linnaeus).—Chenu, 1862: 109, figs. 500–502 [*non* Linnaeus, 1758].

Cardium (Fulvia) bullata (Linnaeus).—Tryon, 1894: 193, 437, pl. 116, fig. 78 [*non* Linnaeus, 1758].

Cardium (Papyridea) spinosum var. *Turtoni* Dall, 1900b:1108; Schuchert et al., 1905:132; Boss et al., 1968: 328 [*non Cardium turtoni* Sowerby (II), 1894 = *Parvicardium turtoni* (Sowerby {II}, 1894)].

Cardium bullatum "Chemnitz".—Lamy, 1941: 462–463 [*partim*].

Papyridea hiatus [*partim*] Clench and Smith, 1944: 17.

Papyridea bullata "Chemnitz".—Nicklès, 1950: 170.

Papyridea hiatus (Meuschen).—McLean, 1951: 71, pl. 15, fig. 1 [*partim*].

Papyridea soleniformis (Bruguière).—Abbott, 1954: 398 [*partim*] [not pl. 39n = *Papyridea lata* (Born, 1778)]; Abbott, 1974: 484 [*partim*] [not pl. 22, fig. 5555 = *Papyridea lata* (Born, 1778)]; Keen, 1980: pl. 6, fig. 11 [*partim*]; Abbott and Dance, 1982: 329, text figure; Voskuil and Onverwagt, 1989: 63, 64, figs. 2.1, 2.1.01, pl. 3, fig. 1; Vermeij and Rosenberg, 1993: 185, 194.

Papyridea (Papyridea) soleniforme (Bruguière).—Fischer-Piette, 1977:69–70 [*partim*].

Description: Shell to 60 mm in length, thin but solid, elongate-oval, compressed, slightly opisthogyrate, inequilateral, with the umbo located 26–33% back from the anterior margin. Posterior of umbones angled with a ridge. Shells gaping antero-ventrally and postero-dorsally, forming pedal and siphonal gapes respectively. Exterior of shell ornamented with 40–48 primary radial ribs, equal in width to the inter-rib spaces anteriorly, becoming wider than inter-rib spaces posteriorly. Postero-dorsal margin dentate. There is a tendency to form secondary ribs posteriorly, particularly along the dorsal side of the primary ribs. Primary ribs triangular in cross-section. Anterior-most primary ~16 ribs and posterior-most ~14 ribs usually ornamented with minute concave scales. Scales cross entire rib on anterior ribs, but are situated on the postero-dorsal side on the posterior ribs. Exterior color consistent on all specimens seen, with white or yellowish background marked with irregular, interspersed rose or purple blotches and flecks that may form vague concentric bands. Some specimens have one or two well-defined, broad rays radiating from the umbones of the same color. These rarely persist on the exterior on specimens past 20 mm. Living and freshly dead specimens have a thin, tan-colored periostracum around the shell margin. Hinge occupying less than 1/2 of total length. Anterior and posterior lateral teeth of equal size. Left laterals small, short, and blade-like. Right laterals slightly larger. Otherwise, lateral teeth and ligament as in *P. lata*. Interior of shell white, with exterior colors showing through. Preserved examples have not been seen.

Type material: *Cardium soleniforme* Bruguière, 1789: Lectotype illustrations, herein selected, Chemnitz, 1782: 65, pl. 6, figs. 49, 50 (see ICZN, 1999: Art. 74.4) (Figure 6). *Cardium (Papyridea) spinosum* var. *turtoni*

Dall, 1900: Syntypes USNM [USGS] 157547, one whole valve, one fragment (figs. 14, 15).

Type locality: *Cardium soleniforme* Bruguière, 1789, based herein on Chemnitz, 1782: unknown. *Cardium (Papyridea) spinosum* var. *turtoni* Dall, 1900: [Pleistocene] of Caloosahatchee River, Florida.

Material examined: BERMUDA: 1.5–3.0 m, Coney Island (GTW, HGL). FLORIDA [Atlantic Ocean]: Palm Beach Co. (UF); 27 m, N of Dodge Estate, Palm Beach Inlet, Palm Brach Co. (UF); 36–46 m, Dodge Estate, Palm Beach Inlet, Palm Brach Co. (UF); Lake Worth, Palm Beach Co. (ANSP, UF); off Breakers Hotel, Palm Beach, Palm Beach Co. (UF); off radio tower, Palm Beach, Palm Beach Co. (UF); 1 m, Bear Cut, Key Biscayne, Dade Co. (GTW, UF); Stiltsville Finger Channels, Dade Co. (HGL, RV, UF); Newfound Harbor Keys, Monroe Co. (UF); Middle Sambo Shoals, Key West, Monroe Co. (UF); off Key West, Monroe Co. (HGL); Fort Jefferson, Garden Key, Dry Tortugas (UF); 1.2 m, 0.27 km S of Fort Jefferson, Garden Key, Dry Tortugas (UF); 1.6 km S of Garden Key, Dry Tortugas (UF); 0–68 m, Dry Tortugas (ANSP). [Gulf of Mexico]: off Tarpon Springs, Pinellas Co. (UF); Little Sarasota Bay (ANSP). BAHAMAS: 20 m, off reef NE of North Point, Great Abaco (ANSP); Grunt Drop, Bimini Lagoon, Bimini (ANSP). PUERTO RICO: Mayaguez (GTW); off Cabo Rojo Lighthouse (UF). VIRGIN ISLANDS: (ANSP); Water Id. (GTW); Honeymoon Bay, St. Thomas (UF); St. Thomas (ANSP). LESSER ANTILLES: 1 m, S side of Long Point, Grenada (ANSP); 7 m, Martinique (ANSP, RV). VENEZUELA: Santa Fé (RV). BRAZIL: 3–6 m, off Clube Iate, Salvador, Bahia State (HGL); 1–3 m, Salvador, Bahia State (HGL). SAO TOMÉ: (ANSP). CAPE VERDE ISLANDS: (ANSP). ST. HELENA: (USNM).

Distribution: Subtidal to at least 46 m. Western Atlantic Ocean and Gulf of Mexico from central Florida to at least Baía de Todos os Santos, Brazil; Bermuda; Caribbean Sea from Cuba to Venezuela. Eastern Atlantic Ocean from Angola (Voskuil and Onverwagt, 1989), Ascension Island (Packer, 1968), St. Helena (Smith, 1890; Dall, 1900b), St. Vincent (Dall, 1900b), Sao Tomé, and Cape Verde Islands. Pleistocene of Florida.

Remarks: In 1787, Meuschen described *"Coeur hiatus"* based on Gualtieri's work (1742: plate 85, figure H), which probably depicts this species (Figure 5). I base this conclusion on the characteristic color pattern of small, separated spots found in *P. soleniformis.* Other aspects of the figure suggest *P. lata,* but overall I believe the figure is closer to *P. soleniformis.* Meuschen also described *"Coeur spinosum,"* from two figures, one of which (Knorr) is unidentifiable. The other figure (Lister) clearly is *P. lata.* Meuschen thus was the first worker to recognize that these were two different taxa. Unfortunately, his work was non-binominal, and subsequent use of them by later authors obliterated his original insight. The name *hiatus* remained unused until resurrected by Clench and Smith (1944), who believed they had uncovered the earliest name for this taxon. Because a non-binominal rejected name does not enter into homonymy (ICZN, 1999: Arts. 11.4, 54.2), their illustration and description resulted in their authorship of the name *Papyridea hiatus.* Their concept included both taxa recognized here, but fortunately earlier names are available for both species. A similar situation exists for Adams's and Adams's 1858 authorship of *spinosum.* Because Adams and Adams introduced the species name in *Papyridea,* there is no conflict with the common *Cardium spinosum* Lightfoot, 1786 [= *Acanthocardia spinosa*]. Clench and Smith (1944) also (?inadvertently) restricted Meuschen's *Coeur spinosum* to Lister's figure.

Chemnitz (1782) illustrated this species as Linnaeus's *Solen bullatus* (Figure 6), but this work is non-binominal and rejected. In 1789 Bruguière described *Cardium soleniforme* based on a list of illustrations that included both taxa, giving a description sufficiently vague as to apply to either species. The name was largely ignored until its use by Keen (1937). It gained immediate popularity with Abbott's use in the 1954 edition of *American Seashells,* and now it is the most widely used of the several names applied to these species. However, that name, as used by Bruguière and later authors, encompassed two species. I hereby restrict the type figure of *Cardium soleniforme* to Chemnitz, 1782, pl. 6, figs. 49, 50 (ICZN, 1999: Art. 74.4), which is clearly identifiable as the species discussed here (Figure 6). This enables this widely used name to continue to be applied to only one of the two taxa.

Dall (1900b) introduced this species as *Cardium spinosum* variety *turtoni,* despite the earlier name *Cardium turtoni* Sowerby (II), 1894. Because varieties proposed before 1961 are considered to be of subspecific rank (ICZN, 1999: Art. 45.6.4), and species and subspecies names may compete as homonyms, Dall's name is a junior homonym. Dall's species was described from the "Pliocene" of the Caloosahatchee River, Florida, now believed to be Pleistocene in age.

Kafanov (1997) placed *Cardium hiulcum* Reeve, 1845, as a synonym of *P. lata* (his concept contained both *P. lata* and *P. soleniformis*). I have not seen Reeve's unlocalized specimen but it seems closest to *P. mantaensis* Olsson, 1961, as suggested by Voskuil and Onverwagt (1991). Both *P. lata* and *P. soleniformis* have cognates in the eastern Pacific Ocean, indicating a Tethyian distribution for their common ancestors. *Papyridea crokeri* Strong and Hertlein, 1937, is the homologue of *P. lata,* and *P. aspersa* (Sowerby, 1833) is the homologue of *P. soleniformis.*

See under *Papyridea lata* for comments on identifying *P. lata* and *P. soleniformis.*

UNIDENTIFIED NAMES AND MISIDENTIFICATIONS

Many references cannot be paired with one or the other species, as evidenced from the following references to *P. lata* and *P. soleniformis* as defined here.

non Rumphius, 1705:pl. 44, fig. N [= an arcid.?].
non Solen bullatus Linnaeus, 1758: 673; Hanley, 1855: 31, 32 [= *nomen dubium, fide* Dodge, 1952].
non Cardium spinosum Lightfoot, 1786. [= *Acanthocardia spinosa* (Lighfoot, 1786)].
non Cardium latum "Born".—Bruguière, 1789: 234 [*partim*]; Gmelin, 1791: 3255; Bosc, 1802: 106; Link, 1807: 151; Wood, 1815: 236; Dillwyn, 1817: 125; Lamarck, 1819:13; Wood, 1825: 27 [all based on Chemnitz, 1782:pl. 19, figs. 192–193 = ? *Maoricardium pseudolatum* Voskuil and Onverwagt, 1991].
non Cardium latum "Gmelin".—Röding, 1798: 190 [based on Chemnitz, 1782: pl. 19, figs. 192–193 = ? *Maoricardium pseudolatum* Voskuil and Onverwagt, 1991].
non Cardium latum "Born".—Reeve, 1845: pl. 6, fig. 21 [= *Maoricardium setosum* (Redfield, 1846)].
non Cardium (Papyridea) bullatum (Linnaeus).—Herrmannsen, 1849:200 [= *nomen dubium, fide* Dodge, 1952].
non Afrocardium latum "Born".—Kirtisinghe, 1978: 28, pl. 11, fig. 12 [= *Maoricardium pseudolatum* Voskuil and Onverwagt, 1991, *fide* Voskuil and Onverwagt, 1991].
non Plagiocardium (Maoricardium) latum "Born".—Lamprell and Whitehead, 1983: 8 [= *Maoricardium pseudolatum* Voskuil and Onverwagt, 1991, *fide* Voskuil and Onverwagt, 1991].
? *Anomalocardia, quæ pectunculus tenuis pellucidus, leviter purpurascens Listeri, in latum oblique expansus vertice obtuso* Klein, 1753: 144 [rejected work].
? *Blasenarrige Herz* Knorr, 1772: 15, pl. 7, fig. 6; also as *Coeur enflé* in Knorr, 1773 and *Blaasagtig Hart* in Knorr, 1775 [rejected work].
? *Cardium soleniforme* "Bosc".—Schumacher, 1817: 159.
? *Cardium bullatum* (Linnaeus).—d'Orbigny, 1842: 337; Hanley, 1843: 130–131; Potiez and Michaud, 1844: 184–185; Conrad, 1846: 393; Beau, 1853:415; Carpenter, 1857: 364.
? *Fulvia bullata* (Linnaeus).—Adams and Adams, 1858: 457.
? *Cardium spinosum* Meuschen.—Krebs, 1864: 116; Krebs *in* Clench *et al.*, 1947: 29.
? *Cardium bullatum* "Lamarck".—Schramm, 1869: 21; Bordaz, 1899: 182.
? *Papyridea bullata* (Linnaeus).—Tryon, 1872: 267; Dall, 1889: 54; Marche-Marchad, 1958: 50.
? *Papyridea soleniforme* (Bruguière).—Tryon, 1872: 26; Olsson and McGinty, 1958: 21; Vokes, 1977: 164–165, 168.
? *Papyridea spinosum* (Meuschen).—Tryon, 1872: 26; Johnson, 1934: 46; McLean, 1936: 118.
? *Cardium (Papyridea) bullatum* "((Linn.?) Chemnitz)".—Smith, 1885: 161–162.
? *Cardium (Papyridea) spinosum* (Meuschen).—Arango, 1887: 259; Dall, 1900a: 387; "M.B.W." 1901: 9–10.
? *Cardium aff. papyraceum* "Chemnitz".—Lorié, 1887: 125.
? *Cardium (Papyridea) bullatum* (Linné).—Smith, 1890: 302–303; Dautzenberg, 1900: 245.
? *Cardium (Fulvia) bullatum* (Linné).—Cockerell, 1894: 105.
? *Cardium (Fulvia) apertum*.—Cockerell, 1894: 105 [*non* Chemnitz, 1782 (non-binominal), *nec* Lightfoot, 1786 (*nomen nudum*), *nec* Bruguière, 1789, *nec* Bosc, 1801].
? *Cardium spinosum* (Meuschen).—Anonymous, 1901: 106.
? *Cardium (Papyridea) spinosum* (Meuschen).—Dall and Simpson, 1902: 489.
? *Papyridea soleniformis* (Bruguière).—Tomlin and Shackleford, 1915: 273; Parker, 1956: 309; Parker and Curray, 1956: 2434; Nowell-Usticke, 1959: 13; Olsson, 1961: 250; Arnow, St. Clair and Arnow, 1963: 170; Matthews and Rios, 1967: 118; Kempf and Matthews, 1968: 90; de Jong and Kristensen, 1968: 23; Rios and Oleiro, 1968: 22–23; Hoerle, 1970: 58 [Lower Pleistocene]; Rosewater, 1975: 33–34; Treece, 1980: 565; Turgeon et al., 1988: 39; Turgeon et al., 1998: 42.
? *Papyridea spinosa* (Meuschen).—Clench and McClean, 1937: 39; Morretes, 1949: 34.
? *Papyridea hiatus* (Meuschen).—Aguayo and Jaume, 1947: No. 21; Poirier, 1952: 28; Morretes, 1954: 41; Coomans, 1963: 170.
? *Papyridea spinosum* (Meuschen).—Baker, 1950: 124.
? *Papyridea (Papyridea) spinosum*.—Haas, 1953: 203.
? *Papyridae [sic] soleniformis* (Bruguière).—Porter and Wolfe, 1971: 100.

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LITERATURE CITED

Abbott, R. T. 1954. American Seashells. Van Nostrand Co., New York, 541 pp.
Abbott, R. T. 1968. Seashells of North America. Golden Press, New York, 280 pp.
Abbott, R. T. 1974. American Seashells (2nd ed.). Van Nostrand Reinhold Co., New York, 663 pp.
Abbott, R. T. and S. P. Dance. 1982. Compendium of Seashells. E. P. Dutton, New York, 411 pp.
Adams, H. and A. Adams. 1858. The Genera of Recent Mollusca, 2. J. Van Voorst, London, 661 pp.
Anonymous. 1901. [Review of Dall, 1900b]. The Nautilus 14: 104–107.
Aguayo, C. G. and M. L. Jaume. 1947–1950. Catalogo de Los Moluscos de Cuba. Privately printed. Unpaginated.
Anton, H. E. 1839. Verzeichniss der Conchylien welche sich in der Sammlung von Hermann Eduard Anton befinden. Halle. xvi+110 pp.
Arango y Molina, R. 1878. Contribución a la Fauna Malacológica Cubana. G. Montiel y Comp., Habana, 280 + 35 pp.
Arnow, L., F. St. Clair and T. Arnow. 1963. The Mollusca of a lagoonal area at Playa de Vega Baja, Puerto Rico. Caribbean Journal of Science 3: 163–172.
Baker, B. B. 1950. Some mollusks near St. Petersburg, Florida. The Nautilus 63: 123–125.
Beau, M. 1853. Supplément au catalogue des coquilles trou-

vées à l'Ile de la Guadeloupe. Journal de Conchyliologie 4: 413–419.
Bordaz, G. 1899. Liste des coquilles recueillies à la Martinique. Bulletin de la Société d'histoire naturelle d'Autun 12: 165–184.
Born, I. von. 1778. Index Rerum Naturalium Musei Caesarei Vindobonensis. J. P. Krauss, Vienna, pp. 1–38, 1–458, 1–83.
Born, I. von. 1780. Testacea musei Caesarei Vindobonensis quae jussu Mariae Theresiae Augustae disposuit et descripsit. J. P. Krauss, Vienna, i–xxxvi, 1–442, text figs., pls. 1–18.
Bory de St. Vincent, J. B. M. 1827. Vers, coquilles, mollusques et polypiers. Tableau encyclopédique et méthodique des trois règnes de la nature, 1. V. Agasse, Paris, 180 pp, pls. 52–488.
Bosc, A. G. 1801–1802. Histoire naturelle des coquilles, contenant leur description, les moeurs des animaux qui les habitent et leurs usages avec figures dessinées d'apres nature, 5. Crapelet, Paris.
Boss, K. J., J. Rosewater and F. A. Ruhoff. 1968. The zoological taxa of William Healey Dall. Bulletin of the U. S. National Museum 287: 1–427.
Brauer, F. 1878. Bemerkungen über die im kaiserlich zoologischen Museum aufgefundenen Original-Exemplare zu Ign. v. Born's Testaceis Musei Caesarei Vindobonensis. Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Classe 77: 117–192.
Bruguière, J. G. 1789–1792. Encyclopédie méthodique. Histoire naturelle des vers. Paris, i–xviii, 1–344 (1789), 345–758 (1792).
Carpenter, P. P. 1857. Report on the present state of our knowledge with regard to the Mollusca of the West Coast of North America. Report of the British Association for the Advancement of Science for 1856: 159–368.
Chemnitz, J. H. 1782. Neues systematisches Conchylien Cabinet geordet und beschreigen von F. H. W. Martini, und unter dessen Aufsicht nach der Natur gezeichnet und mit lebenden Farben erleuchtet, 6. G. N. Raspe, Nürnberg, 36 pls.
Chenu, J. C. 1862. Manuel de conchyliologie et de paléontologie conchyliologique, 2. V. Masson, Paris, 327 pp.
Clench, W. J. 1973. *In*: Morris, P. A. Field guide to shells of the Atlantic and Gulf coasts and the West Indies. Houghton Mifflin, Boston, 330 pp.
Clench, W. J. and R. A. McLean. 1937. Marine bivalves from Little and Great Abaco, Grand Bahama, and Eleuthera, Bahama Islands. Memorias de la Sociedad Cubana de Historia Natural "Felipe Poey" 11: 31–42, pls. 5, 6.
Clench, W. J. and L. S. Smith. 1945. The family Cardiidae in the western Atlantic. Johnsonia 1 (13): 1–32.
Cockerell, T. D. A. 1894. A list of the Brachiopoda, Pelecypoda, Pteropoda, and Nudibranchiata of Jamaica, living and fossil. The Nautilus 7: 102–107, 113–118.
Conrad, T. A. 1846. Catalogue of shells inhabiting Tampa Bay and other parts of the Florida coast. American Journal of Science and Arts 2: 393–398.
Coomans, H. E. 1963. The marine Mollusca of Sint Martin, Lesser Antilles, especially the French part. Journal de Conchyliologie 103: 113–186.
Dall, W. H. 1885. List of marine Mollusca comprising the Quaternary fossils and Recent forms from the American localities between Cape Hatteras and Cape Roque including the Bermudas. Bulletin of the U. S. Geological Survey (24): 1–336.
Dall, W. H. 1889. A preliminary catalogue of the shell-bearing marine mollusks and brachiopods of the southeastern coast of the United States, with illustrations of many of the species. Bulletin of the U. S. National Museum 37: 1–221, 74 pls.
Dall, W. H. 1900a. Synopsis of the family Cardiidae and of the North American species. Proceedings of the U. S. National Museum 23: 381–392.
Dall, W. H. 1900b. Contributions to the Tertiary fauna of Florida with especial reference to the silex beds of Tampa and the Pliocene beds of the Caloosahatchie River. Part V. Teleodesmacea: *Solen* to *Diplodonta*. Transactions of the Wagner Free Institute of Science of Philadelphia 3: 949–1218.
Dall, W. H. 1921. Species named in the Portland Catalogue: I, American. The Nautilus 34: 97–100, 124–132.
Dall, W. H. and C. T. Simpson. 1902. The Mollusca of Porto Rico. Bulletin of the U. S. Fish Commission 20: 351–524.
Dautzenberg, P. 1900. Croisières du yacht *Chazalie* dans l'Atlantique. Mollusques. Mémoires de la Société Zoologique de France 13: 145–265, pls. 9, 10.
de Jong, K. M. and I. Kristensen. 1968. Gegevens over de Mollusken van Curacao uitgezonderd de Mariene Gastropoden. Correspondentieblad van de Nederlandse Malacologische Vereniging, Supplement 68: 1–37, 4 pls.
Dillwyn, L. W. 1817. A descriptive catalogue of Recent shells, arranged according to the Linnaean method; with particular attention to the synonymy, 1. J. and A. Arch, London, i–xii, 1–580.
Dodge, H. 1952. A historical review of the mollusks of Linnaeus. Part I. The classes Loricata and Pelecypoda. Bulletin of the American Museum of Natural History 100: 1–263.
d'Orbigny, A. D. 1842. Mollusques. [in] Ramon de la Sagra, Histoire physique, politique et naturelle de l'Ile de Cuba. 264 pp. [1845] Atlas.
Dunker, R. W. 1853. Index molluscorum, quae in Itinere ad Guineam Inferiorem collegit Georgius Tams Med. Dr. T. Fischer, Cassell, vi+74 pp.
Fischer-Piette, É. 1977. Révision des Cardiidae (Mollusques Lamellibranches). Mémoires du Muséum National d'Histoire Naturelle (n.s. A, Zoologie) 101:1–212, 12 pls.
Gmelin, J. F. 1791. Caroli a Linné Systema naturae per regna tria naturae. 13th ed. Vol. 1, pt. 6, cl. 6. G. M. Beer, Leipzig, pp. 3021–3910.
Gray, J. E. 1847. A list of genera of recent Mollusca, their synonyma and types. Proceedings of the Zoological Society of London 15: 129–219.
Gualtieri, N. 1742. Index testarum conchyliorum quae adservantur in museo Nicolai Gualtieri. Albizzini, Florence. 1–23, 110 pls.
Haas, F. 1953. Mollusks of Ilha Grande, Rio de Janeiro, Brazil. Fieldiana (Zoology) 34: 203–209.
Hanley, S. C. T. 1842–1856. An illustrated and descriptive catalogue of the Recent bivalve shells. Williams and North Gate, London, 334 pp + appendix.
Hanley, S. C. T. 1855. Ipsa Linnæi conchylia. Williams and Norgate, London, 556 pp., 5 pls.
Herrmannsen, A. N. 1847. Indicis generum malacozoorum primordia, 2. T. Fischer, Cassell, 717 pp.
Hoerle, S. E. 1970. Mollusca of the "Glades" unit of southern Florida: Part II. List of molluscan species from the Belle

Glade rock pit, Palm Beach County, Florida. Tulane Studies in Geology and Paleontology 8: 56–68.
Humfrey, M. 1975. Sea shells of the West Indies. Taplinger Publ., New York, 351 pp.
ICZN (International Commission on Zoological Nomenclature). 1999. International Code of Zoological Nomenclature, 3rd ed. International Trust for Zoological Nomenclature, London, xxix +306 pp.
Johnson, C. W. 1934. List of marine Mollusca of the Atlantic coast from Labrador to Texas. Proceedings of the Boston Society of Natural History 40: 1–204.
Kafanov, A. I. 1997. Recent and fossil *Papyridea* (Bivalvia: Cardiidae) of the world. Bulletin of the Mizunami Fossil Museum 24: 1–10.
Keen, A. M. 1937. Nomenclatural units of the pelecypod family Cardiidae. Bulletin du Musée royal d'Histoire naturelle de Belgique 13 (7): 1–22.
Keen, A. M. 1980. The pelecypod family Cardiidae: a taxonomic summary. Tulane Studies in Geology and Paleontology 16: 1–40.
Kempf, M. and H. R. Matthews. 1968. Marine mollusks from north and northeast Brazil. I—Preliminary list. Arquivos da Estação de Biologia Marinha da Universidade Federal do Ceará 8: 87–94.
Kirtisinghe, P. 1978. Seashells of Sri Lanka. Rutland, Tokyo, 202 pp [not seen].
Klein, J. T. 1753. Tentamen Methodi Ostracologicae sive dispositio naturalis Conchlidum et concharum in suas classes, genera et species, iconibus fingulorum Generum aeri illustrati etc. Wishoff. 177+44+15+indices.
[Heirs of] Knorr, G. W. von. 1772. Vergnügen der Augen und des Gemüths in Vorstellung einer allgemeinen Sammlung von Schnecken und Muscheln, 6. Nürnberg, 76 pp.
[Heirs of] Knorr, G. W. von. 1773. Délices des yeux et l'esprit, 6. [French edition of 1772].
[Heirs of] Knorr, G. W. von. 1775. Verlustiging der oogen en van dan geest, of verzameling van allerley bekende hoorens en schulpen, die in haar eigen kleuren afgebeeld zijn. Thans nagezien, verbeterd, vervolgd en met een geheel nieuwe nederduitse beschrijving uitgegeven, 6, pp. 63–118. [Dutch adaptation of 1772].
Kobelt, W. 1876–1881. Illustrirtes conchylienbuch, 2. Bauer and Raspe, Nürnberg, pp. 145–391, 112 pls.
Krebs, H. 1864. The West Indian marine shells. Privately printed. [reprinted in Clench, W. J., Aguayo, C. G. and R. D. Turner. 1947–1948. Revista de la Sociedad Malacologia "Carlos de la Torre" 5: 23–40, 59–80, 91–116 [1947]; 6: 11–43, 45–48 [1948]].
Lamarck, J. B. P. A. de M. de. 1819. Histoire naturelle des animaux sans vértèbres, 6. Paris, 543 pp.
Lamprell, K. and T. Whitehead. 1983. Australian bivalves, Cardiidae. Privately printed, 14 pp. [not seen].
Lamy, E. 1909. Pélécypodes recueillis par M.L. Diguet dans le Golfe de Californe (1894–1905). Journal de Conchyliologie 57: 207–254.
Lamy, E. 1941. Notes sur les espèces Lamarckiennes de *Cardium* (Moll. Lamellibr.). Bulletin du Muséum National d'Histoire Naturelle 8: 458–463.
[Lightfoot, J.] 1786. A catalogue of the Portland Museum, lately the property of the Duchess Dowager of Portland, deceased. Privately printed, London, 194 pp.
Link, H. F. 1807. Beschreibung der Naturalien-Sammlung der Universität zu Rostock. Adler, Rostock, 160+37 pp.
Linnaeus, C. von. 1758. Systema naturae per regna tria naturae. Editio decima, 1. Regnum Animale. L. Salvii, Stockholm, 824 pp.
Lister, M. 1685. Histoire sive synopsis methodicae conchyliorum et tabularum anatomicarum, ed. altera. Oxford, iv+12+77+6 pp., 1059 +22 pls.
Lorié, J. 1887. Fossile Mollusken von Curaçao, Aruba und der Kueste von Venezuela. samml. geol. reichsmus. Leiden (2) 1: 111–149, 2 pls.
"M. B. W." 1901. [Review of Dall, 1900a]. The Nautilus 15:9–10.
Marche-Marchad, I. 1958. Nouveau catalogue de la collection de mollusques testacés marins de l'IFAN. Institut Française d'Afrique Noire, Dakar, 64 pp.
McLean, R. A. 1936. Some marine bivalves from the Bahama Islands. The Nautilus 49:116–119.
McLean, R. A. 1939. The Cardiidae of the western Atlantic. Memorias de la Sociedad Cubana de Historia Natural "Felipe Poey" 13: 157–173, pls. 23–26.
McLean, R. A. 1951. The Pelecypoda or bivalve mollusks of Porto Rico and the Virgin Islands. Scientific Survey of Porto Rico and the Virgin Islands 17(1): 1–183.
Matthews, H. R. and E. de C. Rios. 1967. Segunda contribuiçao ao inventário dos moluscos marinhos do nordeste brasileiro. Arquivos da Estação de Biologia Marinha da Universidade Federal do Ceará 7: 113–121.
Meuschen, F. C. 1787. Museum Geversianum, sive index rerum naturalium. . . comparavit A. Gevers publice distrahendam. J. van Karnebeek, Rotterdam, 659 pp.
Morretes, F. L. de. 1949. Ensaio de catálogo dos moluscos de Brasil. Arquivos do Museu Paranaense 7: 5–216.
Morretes, F. L. de. 1954. Addenda e corrigenda ao Ensaio de catálogo dos moluscos de Brasil. Arquivos do Museu Paranaense 10: 37–76.
Nicklès, M. 1950. Scaphopodes et lamellibranches récoltés dans l'Ouest Africain. Atlantide Report (1):93–237, 41 figs.
Nobre, A. 1909. Máteriaux pour l'etude de la faune malacologique des possessions portugaises de l'Afrique occidentale. Bulletin de la Société Portugaise des Sciences Naturelles 3 (Supplement 2), 108 pp.
Nordsieck, F. 1969. Die europäischen Meeresmuscheln (Bivalvia). G. Fischer, Stuttgart, 256 pp.
Nowell-Usticke, G. W. 1959. A check list of the marine shells of St. Croix, U. S. Virgin Islands, with random annotations. Lane Press, Burlington, 90 pp.
Olsson, A. A. 1961. Mollusks of the tropical eastern Pacific. Panamic-Pacific Pelecypoda. Paleontological Research Inst, Ithaca, 574 pp.
Olsson, A. A. and T. L. McGinty. 1958. Recent marine mollusks from the Caribbean coast of Panama with the description of some new genera and species. Bulletins of American Paleontology 39: 1–58.
Packer, J. E. 1968. The Ascension Handbook. Privately printed. 68 pp [not seen].
Parker, R. H. 1956. Macro-invertebrate assemblages as indicators of sedimentary environments in east Mississippi delta region. Bulletin of the American Association of Petroleum Geologists 40: 295–376.
Parker, R. H. and J. R. Curray. 1956. Fauna and bathymetry of banks on continental shelf, northwest Gulf of Mexico. Bulletin of the American Association of Petroleum Geologists 40: 2428–2439.
Perry, L. M. and J. S. Schwengel. 1955. Marine shells of the western coast of Florida. Paleontological Research Inst., Ithaca, 318 pp.

Poirier, H. 1952. Marine Mollusca of the eastern coast of North America: their names and meanings. Privately printed, 162 pp.

Porter, H. J. and J. Tyler. 1971. Sea shells common to North Carolina. North Carolina Department of Natural and Economic Research, Division of Commercial and Sports Fisheries Information Series, 36 pp.

Porter, H. J. and D. A. Wolfe. 1971. Mollusca from the North Carolina commercial fishing grounds for the calico scallop, *Argopecten gibbus* (Linne). Journal de Conchyliologie 109: 91–109.

Potiez, V. L. V. and A. L. G. Michaud. 1844. Galerie des mollusques ou catalogue méthodique, descriptif et raisonné des mollusques et coquilles du Muséum de Douai, 2. Baillière, Paris, 507 pp.

Reeve, L. A. 1844–45. Monograph of the genus *Cardium*. Conchologica iconica, 2. London, 22 pls. + text.

Reibisch, T. 1865. Uebersicht der Mollusken, welche bis jetzt an und auf den Capverdischen Inseln gefunden worden sind. Malakozoologische Blätter 12: 125–133.

Richardson, L., Abbott, R. T. and G. M. Davis. 1979. Early references to the figures in the Conchylien Cabinet of Martini and Chemnitz: Volumes I-XII. Tryonia (2):1–427, 432 pls., 70 vigns.

Rios, E. C. 1975. Brazilian marine mollusks iconography. Universidade do Rio Grande, Centro de Ciências do Mar, Museu Oceanográfico, Rio Grande, 331 pp, 91 pls.

Rios, E. C. 1994. Brazilian Marine Mollusks Iconography (2nd ed.). Fundação Universidade do Rio Grande, Rio Grande, 368 pp, 113 pls.

Rios, E. C. and A. P. Oleiro. 1968. Estudos malacológicos na costa brasileira. Instituto de Pesquisas da Marinha, Publicação 31: 1–28, 2 maps.

Röding, P. F. 1798. Museum Boltenianum sive Catalogus cimeliorum e tribus regnis naturæ quæ olim collegerat Joa. Fried Bolten, M.D.p.d. J. C. Trappii, Hamburg, i–vii+199 [reprinted 1906, Sherborn and Sykes; 1986, American Malacological Union, Inc.].

Römer, E. 1868–69. Die Familie der Herzmuscheln, Cardiacea. Systematisches Conchylien-Cabinet von Martini und Chemnitz. Neu herausgageben von vervollstaendigt von H. C. Kuester. 10(2), 124 pp, 14 pls.

Rosewater, J. 1975. An annotated list of marine mollusks of Ascension Island, south Atlantic Ocean. Smithsonian Contributions to Zoology 189: 1–41.

Rumphius, G. E. 1705. Ambionische Rariteitkammer, of eene beschryvinge van allerhande Schoalvisschen; benevens de Voornaamste Hoorntjes en Schulpen, als ook zommige, mineraalen, gesteenten, enz. Amsterdam. Forward + 340 pp. + index, 60 pls.

Schramm, M. A. 1869. Catalogues des coquilles et des crustacés de la Guadeloupe envoyés a l'Exposition Universelle de 1867 (2nd ed.). Government of Guadeloupe, Basse-Terre, 27 pp.

Schuchert, C., W. H. Dall, T. W. Stanton and R. S. Bassler. 1905. Catalogue of the type specimens of fossil invertebrates in the Department of Geology, United States National Museum. Bulletin of the U. S. National Museum 53: 1–704.

Schumacher, C. F. 1817. Essai d'un nouveau système des habitations des vers testacés. Copenhagen, Schultz, 287 pp.

Smith, E. A. 1885. Report on the Lamellibranchiata collected by H.M.S. Challenger during the years 1873–76. Zoology of the Challenger Expedition 13: 1–341, 25 pls.

Smith, E. A. 1890. Report on the marine molluscan fauna of the island of St. Helena. Proceedings of the Royal Society of London for the Year 1890: 247–317, pls. 21–24.

Smith, L. C. 1945. Notes on the family Cardiidae. Occasional Papers on Mollusks (4): 29–32.

Smith, M. 1937. East Coast Marine Shells. Edwards Brothers, Ann Arbor, 308 pp.

Sowerby [II], G. B. 1834–1841. The Conchological Illustrations, *Cardium*. London. 8 pp. [1841], plates [1834].

Stanley, S. M. 1970. Relation of shell form to life habits in the Bivalvia. Memoirs of the Geological Society of America 125: 1–296.

Swainson, W. 1840. A Treatise on Malacology or the Natural Classification of Shells and Shell-fish. Longmans et al., London, 419 pp.

Tomlin, J. R. le B. and L. J. Shackleford. 1914–1915. The Mollusca of São Thomé, I. Journal of Conchology 14: 239–256 [1914]; 14: 267–276 [1915].

Treece, G. D. 1980. Bathymetric records of marine shelled Mollusca from the northeastern shelf and upper slope of Yucatan, Mexico. Bulletin of Marine Science 30: 552–570.

Tryon, G. W. 1894. Structural and Systematic Conchology, 3. Privately printed, Philadelphia. 453 pp., pls. 92–140.

Tryon, G. W. 1872. Catalogue of the Recent species of the family Cardiidæ. American Journal of Conchology 7: 259–275.

Turgeon, D. D., A. E. Bogan, E. V. Coan, W. K. Emerson, W. G. Lyons, W. L. Pratt, C. F. E. Roper, A. Scheltema, F. G. Thompson and J. D. Williams. 1988. Common and Scientific Names of Aquatic Invertebrates from the United States and Canada. American Fisheries Society Special Publication 16, 277 pp.

Turgeon, D. D., J. F. Quinn, Jr., A. E. Bogan, E. V. Coan, F. G. Hochberg, W. G. Lyons, P. M. Mikkelsen, R. J. Neves, C. F. E. Roper, G. Rosenberg, B. Roth, A, Scheltema, F. G. Thompson, M. Vecchione and J. D. Williams. 1998. Common and Scientific Names of Aquatic Invertebrates from the United States and Canada. 2nd Ed. American Fisheries Society Special Publication 26, 526 pp.

Vermeij, G. J. and G. Rosenberg. 1993. Giving and receiving: the tropical Atlantic as donor and recipient region for invading species. American Malacological Bulletin 10: 181–194.

Vilas, C. N. and N. R. Vilas. 1945. Florida Marine Shells. Aberdeen Press, Chicago, 151 pp.

Vokes, H. E. 1977. Cardiidae (Mollusca: Bivalvia) from the Chipola Formation, Calhoun County, Florida. Tulane Studies in Geology and Paleontology 13: 143–189.

Vokes, H. E. and E. H. Vokes. 1983. Distribution of shallow-water marine Mollusca, Yucatan peninsula, Mexico. Mesoamerican Ecology Institute Monograph 1: 1–183.

Voskuil, R. P. A. and W. J. H. Onverwagt. 1989. Inventarisation of the Recent European and West African Cardiidae (Mollusca, Bivalvia). Gloria Maris 28 (4–5): 49–96.

Voskuil, R. P. A. and W. J. H. Onverwagt. 1991. Studies on Cardiidae. 3. The recent species of *Maoricardium* Marwick, 1944 (Mollusca, Bivalvia), with description of a new species. Basteria 55: 25–33.

Warmke, G. L. and R. T. Abbott. 1961. Caribbean Seashells. Livingston Publications, Wynnewood, 348 pp.

Watters, G. T. 1993. Some aspects of the functional morphology of the shell of infaunal bivalves (Mollusca). Malacologia 35: 315–342.

Wood, W. 1815. General Conchology, 1. J. Booth, London, 246 pp.
Wood, W. 1825. Index Testaceologicus: or a Catalogue of Shells, British and Foreign, Arranged According to the Linnaean System. London, xxxii+188 pp.
Wood, W. 1835. General Conchology (2nd ed.). J. Booth, London, 246 pp.
Wood, W. 1856. *In*: S. C. T. Hanley, Index Testaceologicus, an Illustrated Catalogue of British and Foreign Shells. Willis and Sotheron, London, 234 pp, 38 + 8 pls..

A new *Trigonostoma* (Neogastropoda: Cancellariidae) from Mozambique

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ABSTRACT

Trigonostoma mozambicense is described from the outer continental shelf off southern Mozambique. This new species is readily distinguished from its congeners by its combination of small adult size, its thick shell with coarsely fenestrated surface sculpture, a narrow umbilicus lined with spiral cords, as well as the presence of strong but shallow apertural lirae between the suture and shoulder, and along the outer lip. This new species is provisionally assigned to the genus *Trigonostoma* based on characters traditionally used to define the genus, while its affinity to a western African species that has been included in the genus *Scalptia* is also recognized.

Additional key words: Indian Ocean, Gastropoda *Scalptia.*

INTRODUCTION

The Cancellariidae is a family of diverse, highly specialized, suctorial gastropods that inhabit soft-bottom, subtidal to bathyal habitats throughout tropical and temperate seas. The shallow-water Cancellariidae of Mozambique were monographed by Petit (1980). The South African representatives of the family were reviewed by Barnard (1959) and Kensley (1973) and in recent popular works by Richards (1981) and Steyn and Lussi (1998). Several additional species were added to the South African fauna in papers by Petit and Harasewych (1991, 2000a, 2000b). Increased biological sampling along outer continental shelf and upper slope depths continues to bring to light previously unknown biota. Over the past year, the Amorim family has kindly made available specimens of newly discovered gastropods from off Mozambique (e.g. Harasewych and Fraussen, 2001), among them the new species of cancellariid described herein.

SYSTEMATICS

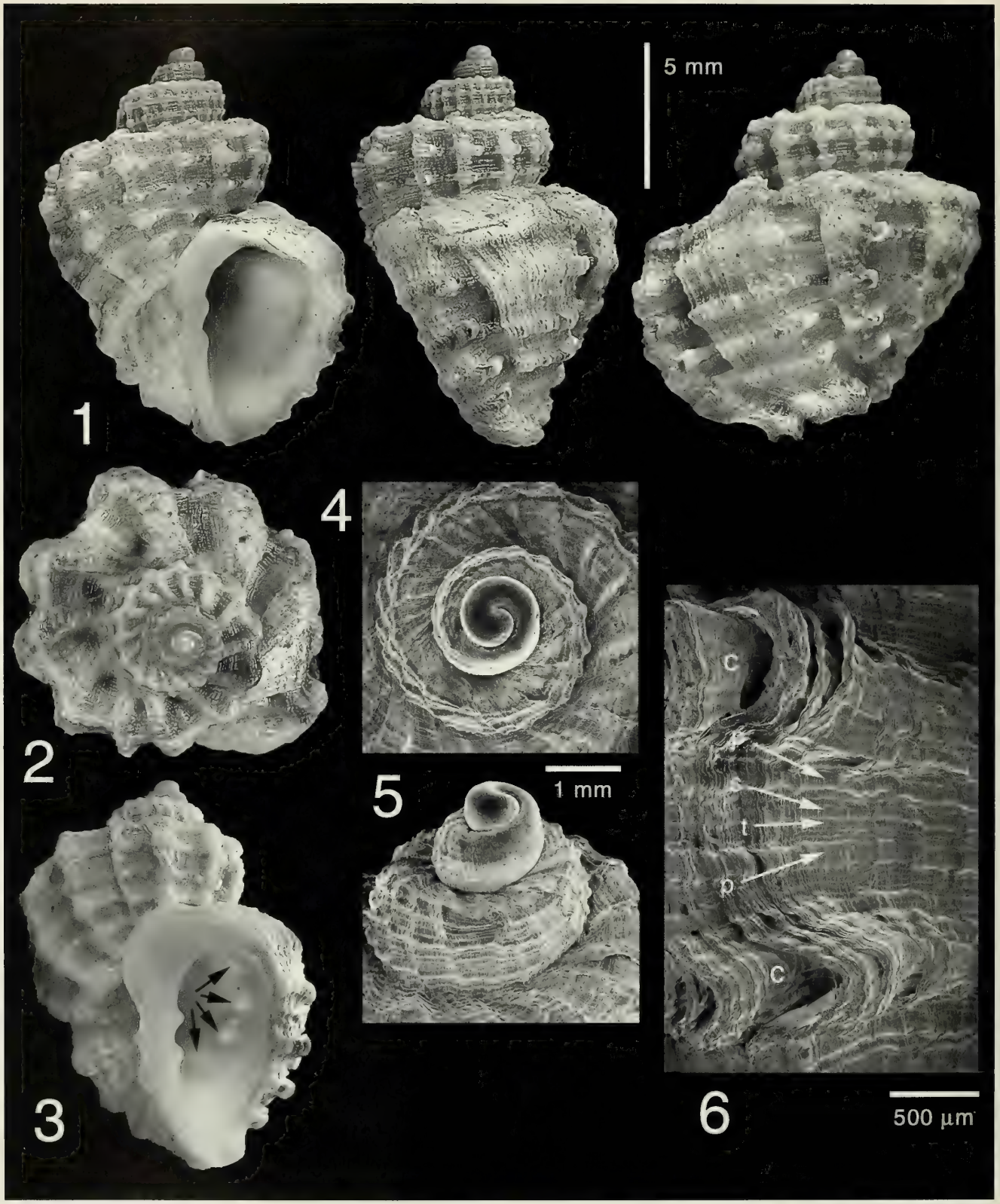
Family Cancellariidae Forbes and Hanley, 1851
Genus *Trigonostoma* Blainville, 1827

Type Species: *Delphinula trigonostoma* Lamarck, 1822 (?= *Buccinum scalare* Gmelin, 1791) by monotypy.

Trigonostoma mozambicense new species
(Figures 1–6)

Diagnosis: A small species with a thick, broadly tabulate, narrowly umbilicate shell with strong, scabrous axial ribs and spiral cords that produce a fenestrated surface sculpture. Umbilicus lined with spiral cords. Outer lip with strong, short lirae between suture and shoulder as well as between shoulder and siphonal canal.

Description: Shell (Figures 1–2) small, reaching 16.1 mm, heavy, ovately biconical, strongly shouldered, with deep, narrow umbilicus. Spire relatively short (spire angle 83°), comprising just over half the shell length. Protoconch (Figures 4–5) increasing in diameter from 0.52 mm to 1.38 mm in 1⅔ smooth, inflated, slightly cylindrical whorls. Transition to teleoconch sharply demarcated by onset of spiral cords and numerous, fine, axial, growth lamellae, followed within ¼ whorl by axial ribs. Teleoconch with up to 3¼ sharply angled whorls. Suture weakly impressed on first two teleoconch whorls, abutting to weakly adpressed on last whorl. Axial sculpture of sharp, prosocline ribs (14–17 on penultimate whorl) that become less numerous (8–12), and progressively broader, more widely spaced and more scabrous on last whorl, producing distinctive, fenestrated surface sculpture. Spiral sculpture consists of strong cords (Figure 6, C) and primary (Figure 6, p), secondary (Figure 6, s) and tertiary (Figure 6, t) threads that overlay both cords and intervening spaces. Spiral cords are absent on tabulate shoulder, 3 cords present from periphery to suture, 6 cords on last whorl, cords strongest on periphery and siphonal fasciole. Aperture sharply triangular, offset from shell axis by 18°. Siphonal canal short, well defined, slightly deflected dorsally. Outer lip thick, weakly flared, crenulated beneath spiral cords, with 3 strong, shallow teeth along the tabulate region of the whorl (evident only in holotype) and 9 strong teeth along outer lip, beneath last axial rib (varix). Varices and spiral cords demarcate uniquely translucent regions within outer lip (Figure 3, arrows). Short parietal region forms an angle of 130° with long, straight columella that bears 2 strong



Figures 1–6. *Trigonostoma mozambicense* new species. Collected by fishing boats south of Bazaruto and north of Maputo, Mozambique, in 100–150 m. **1.** Apertural, right lateral, and dorsal views of holotype, USNM 1007053. **2.** Apical view of holotype. **3.** Aperture of holotype, oblique view showing translucent areas (arrows). **4.** Apical and **5.** Oblique view of protoconch of holotype. **6.** Detail of spiral sculpture. Abbreviations: c, cords; p, primary threads; s, secondary threads; t, tertiary threads. Scale bar (3 mm) applies to all whole shells.

columellar folds near mid-length and a nearly indiscernible siphonal fold. A short parietal callus spans the inductural region. Umbilicus, deep, narrow, spiral cords within, well defined by thick, prominent siphonal fasciole. Shell base color light brown, maculated with dark brown patches between axial cords, especially on tabled shoulder near suture and/or periphery. Protoconch and early whorls pinkish brown. Radula and anatomy unknown.

Type locality: South of Bazaruto and north of Maputo, Mozambique, in 100–150 m.

Material examined: Holotype (National Museum of Natural History, Smithsonian Institution, USNM 1007053); paratype 1 (Natal Museum, Pietermaritzburg, L5749/T1917), Paratypes 2–3, Amorim collection. All collected by fishing boats based in Maputo, Mozambique, March 2001, from the type locality; paratype 4, Brink Collection, off Quissico/Zavora, Mozambique, in fish trap at 120–150 m, December 2001, collected by José Rosado; Paratype 5, Petit Collection #2724, off Quissico/Zavora, Mozambique, in fish trap at 120–150 m.

Remarks: This new species most closely resembles the west African *Scalptia scala* (Gmelin, 1791) [often listed under its junior synonym *Scalptia withrowi* (Petit, 1976)], as well as the Panamic species *Trigonostoma goniostoma* (Sowerby, 1832) and *Trigonostoma breve* (Sowerby, 1832) in general shell morphology, and in sharing several unusual shell characters, among them: a tabulate shell that is pigmented near the suture, the presence of denticles under the sutural ramp, a strongly defined siphonal fasciole, and the presence of strong cords within the umbilicus. *Trigonostoma mozambicense* may be readily distinguished from *S. scala* on the basis of its smaller shell, its broader, more scabrous axial sculpture, in having fewer, stronger and shallower apertural lirae, and in having two columellar folds rather than three folds of *S. scala*. *Scalptia scala* has fine pustules or denticles along the columella, which are lacking in *T. mozambicense*. Like *Trigonostoma goniostoma* and *T. breve*, *T. mozambicense* has two columellar folds. However, it can readily be distinguished from both Panamic species by its smaller shell size, its more rounded whorls, its rounded periphery, and by having broader, more scabrous axial ribs.

While this new species is readily distinguished from other cancellariids on the basis of its shell morphology, there is some question as to its correct generic placement. The species with which it is compared appear to comprise a coherent group. Additional material and further study will be required to confirm the monophyly of this group, to define more precisely the limits and relationships of the genera *Trigonostoma* and *Scalptia*, and to determine the relationship of this group to these genera. Over a century ago Cossmann (1899: 16) discussed the differences between *Scalptia* and *Trigonostoma* and assigned these genera to different subfamilies.

We provisionally include this new species in *Trigonostoma* as it shares a number of features that have been used to diagnose *Trigonostoma* (e.g., two columellar folds, a straight columella, an umbilicus).

ACKNOWLEDGMENTS

We are grateful to the Amorim family (Mozambique and Portugal) for bringing this species to our attention, and for providing the much of the type material. Thanks are due to Dawn Brink of South Africa for obtaining and making additional specimens available for study.

LITERATURE CITED

Barnard, K. H. 1959. Contributions to the knowledge of South African marine Mollusca. Part II. Gastropoda: Prosobranchiata: Rhachiglossa. Annals of the South African Museum 45: 1–237.

Gmelin, J. F. 1791. Caroli a Linné Systema Naturae per regna tria naturae. Editio decima tertia. Vol. 1, pt. 6 (Vermes) Lipsiae, pp. 3021–3910.

Harasewych, M. G. and K. Fraussen. 2001. *Coluzea groschi*, a new species of Columbariinae (Gastropoda: Turbinellidae) from Southeastern Africa. Novapex 2: 171–174.

Kilburn, R. and E. Rippey. 1982. Sea Shells of Southern Africa. Macmillan South Africa, Johannesburg, xi + 249 pp.

Petit, R. E. 1976. Notes on Cancellariidae (Mollusca: Gastropoda)—III. Tulane Studies in Geology and Paleontology 12: 33–43, pls. 1–2.

Petit, R. E. 1980. The Mozambique Cancellariidae (Mollusca: Gastropoda). Annals of the Natal Museum 24: 211–216.

Petit, R. E. and M. G. Harasewych. 2000a. Additions to the cancellariid (Mollusca: Neogastropoda) fauna of South Africa. Proceedings of the Biological Society of Washington 113: 145–154.

Petit, R. E. and M. G. Harasewych. 2000b. Three new species of the genus *Merica* (Neogastropoda: Cancellariidae) from South Africa and the Philippines. The Nautilus 114: 142–148.

Richards, D. 1981. South African Shells. A collector's guide. C. Struik, Cape Town, 98 pp., 60 pls.

Sowerby, G. B., I. 1832. Genus *Cancellaria*. In: W. J. Broderip and G. B. Sowerby, Characters of new species of Mollusca and Conchifera, collected by Mr. Cuming. Proceedings of the Zoological Society of London for 1832: 50–55.

Steyn, D. G. and M. Lussi. 1998. Marine Shells of South Africa. Ekogilde, Hartbeespoort, South Africa, 264 pp.

Samuel Liberty Harvey Fuller (1942–2001): a biographical sketch and his works on malacology

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ABSTRACT

This article lists all of Samuel Liberty Harvey Fuller's almost 60 publications, most of which treat Unionoidea. Fuller described a new molluscan taxon, *Elliptio marsupiobesa*, in 1972.

Additional key words: new species, taxonomy, biogeography, North America.

Samuel (Sam) Liberty Harvey Fuller was born on March 2, 1942, the first son of Alan Henry and Vera Harvey Fuller. He spent his childhood on land that had been farmed by his family for four generations. The Fullers were amongst the earliest settlers of Suffield, Connecticut, where they persist in some numbers to this day and have long been prominent in the affairs of Suffield Academy. During Fuller's youth his father was forced to give up tobacco growing because of a new development in the manufacture of cigar wrappers to become a teacher of mathematics at Suffield Academy, Suffield, Connecticut. Sam's early penchant for natural history was encouraged by his parents who took him on Saturdays to Springfield, Massachusetts. There he spent mornings at the YMCA and afternoons at the Springfield Natural History Museum. He became a role model for his three younger siblings, Henry, Woodbridge (Woody), and a sister, Tamsen. Woody Fuller, who spent hours with his brother searching for freshwater mussels along the Windsor Locks Canal, called Sam a "curiosity mentor and a natural teacher. He helped me to be curious about the world. He was good at stimulating interest in other people."

A brilliant student at Wooster, Sam was one of the few who graduated with a "6 average," its most superior grade. He achieved perfect SAT scores and became, I believe, the first of his branch in a long line of Fullers in America to attend Harvard College, where he enjoyed a Harvard National Scholarship (1960–1963). In his first letter to the Museum of Comparative Zoology, dated March 26, 1958, Sam begins, "Dear Sirs: I am sending to your department several varieties of freshwater mollusk which I hope you might identify for me." This was the beginning of a beautiful friendship with Curator William J. Clench that lasted until Clench's death in 1984. Sam spent much time during his undergraduate years at the Department of Mollusks, where he would usually appear as a tatterdemalion. He dressed as a gentleman only when he set off to Roxbury to tutor underprivileged children. He spent the month of August and some of September 1961 collecting in the rivers of Georgia with Clench and Kenneth Jay Boss, who would later succeed Clench as Curator of Mollusks. Early in the trip, while on the quest for large *Elliptio hopetonensis*, at the first really successful collecting site in the Altamaha River, Boss rescued Sam from almost certain drowning.

The following summer, Sam joined me, my wife, and two small daughters on an "expedition", as we called it, to peninsular Florida to collect freshwater mussels. He was an excellent babysitter, able to keep the girls amused, and a fine field collector. We made 49 successful collecting stops. He humored my then wife when she tried to help interpret our county maps her way. They were able to establish distant kinship through Stephen Fuller Austin, the Texan hero of the Alamo who had also been born in Suffield, Connecticut. It was Sam's responsibility to navigate whilst one of us drove. He worked on his life list of birds, and would cry out the name of each one he sighted which was new to him. In the evenings after the last shell had been cleaned, he would practice on his guitar, for which he had no talent, or else read avidly the works of William Faulkner or novels such as *Steppenwolf* and *Demian* by Herman Hesse. Before the summer was over, I was also reading these books and discussing them with Sam. In 1964, upon graduating from Harvard with a degree in biology, Sam received a Ford Foundation grant and went to Tanzania for a year as an instructor at the Kurasini International College. He left behind June, the Radcliffe junior he intended to marry, to complete her undergraduate studies.

Sam had several narrow escapes in Africa, one of which was an attack by a swarm of killer bees. Through

[1] Associate in Malacology

his own accounts and by my observations Sam was accident-prone. In an amusing 1971 article, one of several Sam wrote for the Academy's popular publication, *Frontiers*, he relates, "I picked my way across Old Brown's yard, knocked, and tripped flat on my face into the kitchen." I had planned another trip to the South for him when he returned from Africa, but his commitment to civil rights, shared by his fiancée whose parents were social workers, and their determination to collect and participate in the civil rights movement, led me to cancel the trip. Those were troubled times in the South and I insisted that civil rights work, although admirable, could be done effectively only under the protection of an umbrella organization.

Upon Sam's return to the United States, June put off the wedding because of the recent death of her father. Eventually, their engagement was dissolved. Sam took a post teaching at the Wooster School in Danbury, Connecticut, from which he had so brilliantly graduated not many years before. In 1968, Sam wrote to Dr. Clench informing him that he was to be married to Mary (Micki) Lou Bush at the Wooster School. Soon after their marriage, Dr. Ruth Patrick of the Department of Limnology of the Academy of Natural Sciences in Philadelphia called me about a position to assist in her department. Since it did not interest me, I recommended Sam, who I thought to be a perfect candidate. With some trepidation, he accepted Dr. Patrick's offer. Micki and he settled in New Jersey where they became parents of two children. A glance at Sam's bibliography between 1971 and 1981 reveals his impressive contributions to the study of Unionoidea. Without ever taking a higher degree, he had schooled himself in their anatomy and molecular genetics. He was also responsible for an extensive geographic survey of the mussels of the Upper Mississippi River and led symposia on endangered species. Sam also found time to act as an instructor at Rutgers University, New Brunswick, New Jersey.

His independent work habits appear eventually to have caused his severance from the Academy. He returned to Connecticut where the family was in a serious automobile accident, not of his making, in October 1973. His son, Samuel, Jr., was killed and his daughter, Rebecca, seriously injured. A divorce ensued.

In 1990, Sam wrote, "I seem to be back in biology after seven lean, unwelcome years of sorrow and loss." After an absence of a quarter of a century, Sam paid a visit to the Department of Mollusks at Museum of Comparative Zoology when he was on his way to Florida to work again on his favorite mollusks as Research Associate with James D. Williams of the National Fisheries Research Center of the U.S. Fish and Wildlife Service in Gainesville, Florida. After a few years there, he disappeared from view, only to reappear through the kindness of Mrs. Deborah M. Heath, who saw that he was comfortably cared for before his death of lung cancer on April 13, 2001. He had earlier predicted that lung cancer would get him as it had his father. He and I carried on a spirited correspondence toward the very end. In his last letter to me from Ocala, Florida, he mentioned his intention of naming a new species of mussel after me.

Harvard College graduates stage reunions every five years and publish a volume of autobiographies of classmates on each occasion. There seems to be an indication that those who contribute to Class Reports live longer than those who do not. It does not follow that the longer the report, the longer the life. Samuel Liberty Harvey Fuller never contributed to a Class Report. He was listed as "lost" at the Wooster School until shortly before his death. He is now listed "In Memoriam" with his Harvard Class of 1964.

NEW TAXA INTRODUCED BY SAMUEL LIBERTY HARVEY FULLER

splendens, Gnathophyllum Chase and Fuller, 1971 (Decapoda, Caridea). Proceedings of the Biological Society of Washington (1970) 83: 493–505 (Puerto Yabucoa, 0.5 mi. E Playa de Guayanés, Municipio de Yabucoa, Puerto Rico; holotype United States National Museum 134422 [only specimen]).

marsupiobesa, Elliptio Fuller, 1972. Proceedings of the Academy of Natural Sciences of Philadelphia 124(1): 1–10, pl. 1, fig. 1 (Cape Fear River, 0.1 mile downstream from Carvers Creek, about 3 miles SW of Slocomb, and about 6 miles NNE of Fayetteville, Cumberland Co., North Carolina). Female holotype Academy of Natural Sciences of Philadelphia (ANSP) 324501; paratypes Museum of Comparative Zoology (MCZ) 272780, ANSP 324502(16), 324503(2), 324504(3), 324505(1).

BIBLIOGRAPHY OF SAMUEL LIBERTY HARVEY FULLER

Fuller, S. L.H. 1965. Untapped Tanzania riches. Nationalist, Dar es Salaam, Tanzania, 1 p. [February 4]

Clench, William J. and S. L. H. Fuller. 1965. The genus *Viviparus* (Viviparidae) in North America. Occasional Papers on Mollusks 2(32): 385–412, pls. 64–68. [July 9]

Hendrickson, Jr., John A., S. L. H. Fuller and Katherine B. Roop. 1970. An ecology handbook. Frontiers 34(5): 18–21. [June]

Fuller, S. L. H. 1970. Fuller's earth. Wooster News, Wooster School News, Danbury, Connecticut, pp. 4–13. [Fall Term Issue].

Fuller, S. L. H. 1971. Pond Life [review]. Bulletin of the Philadelphia Herpetological Society 18: 49.

Chace, Jr., Fenner A. and S. L. H. Fuller. 1971. A new shrimp of the genus *Gnathophyllum* (Decapoda, Caridea) from Puerto Rico. Proceedings of the Biological Society of Washington 83(4): 493–504, text figs. 1–7. [February 9]

Figure 1. Samuel Liberty Harvey Fuller. October, 1973.

Fuller, S. L. H. 1971. Everything you always wanted to know about freshwater mussels but were afraid to ask. Frontiers 35(5): [1]2–9. [June]

Fuller, S. L. H. 1971. Fossils and Flies–The life of a Complete Scientist, Samuel Wendell Williston (1851–1918) [review] Frontiers 36(1): 30–31. [October–November]

Fuller, S. L. H. 1971. A brief field guide to the freshwater mussels (Mollusca: Bivalvia: Unionacea) of the Savannah River system. ABS [Association of Southeastern Biologists] Bulletin 18(4): 137–146, text figs. 1–14, 1 pl.

Fuller, S. L. H. and C. W. Hart, Jr. 1972. Changes along the Patuxent. Frontiers 36(3): 2–7.

Fuller, S. L. H. 1972. *Uganda Quest* [review]. Frontiers 36(4): 29. [April]

Hart, C. W., Jr., and S. L. H. Fuller. 1972. Environmental degradation in the Patuxent River Estuary, Maryland. Contributions from the Department of Limnology Academy of Natural Sciences of Philadelphia 1:1–14. [September]

Fuller, S. L. H. 1972. Ecotage! [review] 37(1): 31–32. [October]

Fuller, S. L. H. 1972. *Elliptio marsupiobesa*, a new fresh-water mussel (Mollusca: Bivalvia: Unionidae) from the Cape Fear River, North Carolina. Proceedings of the Academy of Natural Sciences of Philadelphia 124: 1–10, 6 figs. [November 24]

Fuller, S. L. H. 1972. Type locality of *Unio pumilus* Lea, 1838 (Unionidae). The Nautilus 86: 72–73. [November]

Fuller, S. L. H. 1972. *Unio caroliniana* Bosc, 1801 (Unionidae). The Nautilus 86: 74–75. [November]

Fuller, S. L. H. 1972. An undescribed structural feature in the marsupium of *Elliptio lanceolata* (Lea 1828) (Unionidae): The Nautilus 86: 85–86. [November]

Powell, Jr., S. L. H. Fuller and C. W. Hart, Jr. 1972. Some advantages and disadvantages of a multiple-plate conservation webbing artificial substrate as a supplement to hand collecting of macroinvertebrates in Chesapeake Bay. ABS [Association of Southeastern Biologists] Bulletin 19(2): 92.

Fuller, S. L. H. and Charles E. Powell, Jr. 1973. Range extensions of *Corbicula manilensis* (Philippi) in the Atlantic drainage of the United States. The Nautilus 8: 59. [April]

Fuller, S. L. H. 1973. The spiny shells of the Altamaha. Frontiers 37(4): 14–15. [summer]

Fuller, S. L. H. and D. J. Bereza. 1973. Recent additions to the naiad fauna of the eastern Gulf drainage (Bivalvia: Unionoidae) (Abstrace). ASB [Association of Southeastern Biologists] Bulletin 20(2): 53–54.

Fuller, S. L. H. 1974. *Fusconaia masoni* (Conrad 1834) (Bivalvia: Unionacea) in the Atlantic drainage of the southeastern United States. Malacological Review 6: 105–117. [January 29]

Fuller, S. L. H. 1974. A misunderstood fresh-water mussel from the Savannah River system in South Carolina (Bivalvia: Unionidae) (Abstract). ASB [Association of Southeastern Biologists] Bulletin 21(2): 55–56. [April]

Fuller, S. L. H. 1974. Neglected papers on naiads by W. I. Utterback. The Nautilus 88: 90. [July 22]

Fuller, S. L. H. 1974. The Life of Captain James Cook [review]. Frontiers 38(4): 31. [summer]

Fuller, S. L. H. 1974. The journey of the Chinese clam. Frontiers 39(2): 12–13. [winter]

Fuller, S. L. H. 1974. Biota of Freshwater Ecosystems: A review. ASB [Association of Southeastern Biologists] Bulletin 21(3): 109–112.

Fuller, S. L. H. 1974. Clams and mussels (Mollusca: Bivalvia): In: Hart, Jr., C. W. and S. L. H. Fuller (Eds.) Pollution ecology of freshwater invertebrates. Academic Press, New York and London. Chapter 8, pp. 215–273.

Fuller, S. L. H. 1974. Macroinvertebrates. In: Savannah River Biological Survey, South Carolina and Georgia, May and September, 1972 for I. E. duPont de Nemours & Co. Department of Limnology and Ecology, Academy of Natural Sciences of Philadelphia, pp. 56–76, 147–150 [proprietary to I.E. duPont de Nemours & Co.; not seen].

Fuller, S. L. H. 1974. Macroinvertebrates (and) Quantitative macroinvertebrate samples. pp. 49–69, 143–145 [in] Cooper River Survey for 1973 for I. E. duPont de Nemours & Co. Department of Limnology and Ecology, Academy of Natural Sciences of Philadelphia [proprietary to I. E. duPont de Nemours & Co.; not seen].

Bereza, D. J. and S. L. H. Fuller. 1975. Notes on *Lampsilis ochracea* (Say) (Mollusca: Bivalvia). (Abstract) ASB [Association of Southeastern Biologists] Bulletin 22(2): 42.

Fuller, S. L. H. 1975. Fresh-water mussels (Mollusca: Bivalvia) in the Chowan River system of Virginia. (Abstract). ASB [Association of Southeastern Biologists] Bulletin 22(2): 54.

Fuller, S. L. H. 1975. The systematic position of *Cyrtonaias* (Bivalvia: Unionidae). Malacological Review 8: 81–89.

Fuller, S. L. H. and D. J. Bereza. 1975. The value of anatomical characters in naiad taxonomy (Bivalvia: Unionacea). Bulletin of the American Malacological Union, 1974: 21–22.

Fuller, S. L. H. 1975. Macroinvertebrates (excluding insects) Appendix B, B-1-B-26 [in] Hendrickson, John A., Final report submitted to National Commission on Water Quality under Contract No. WQ5ACo44 on selected segments of the Santee River basin. XI. Biological, ecological, and environmental characteristics of the site. p. X-1 to XI-69. XIV-1 to XIV-13, A-2 to A-30, B-1 TO B-26, C-1 to C-17, D-1 to D-15, E = 1 to E-4, F-1 to F-3, G-1 to G-3, H-1 to H-4. Department of Limnology Academy of Natural Sciences of Philadelphia. (Subsequently distributed by National Technical Information Service, 5283 Port Royal Road, Springfield, Virginia. [July]

Bereza, D. J., M. F. Vidrine and S. L. H. Fuller. 1976. Anatomical differences between *Ligumia nasuta* (Say) and *L. subrostrata* (Say). (Abstract) ASB [Association of Southeastern Biologists] Bulletin 23(2): 43.

Fuller, S. L. H. 1976. Apparent resurgence of *Hydrolimax grisea* (Haldeman), the Grizzly Water Slug (Platyhelminthes: Turbellaria: Alloecoela). ASB [Association of Southeastern Biologists] Bulletin 23: 60.

Fuller, S. L. H. and M. J. Imlay. 1976. Spatial competition between *Corbicula manilensis* (Philippi), the Chinese Clam (Corbiculidae), and fresh-water mussels (Unionidae) in the Waccamaw River basin in the Carolinas (Mollusca: Bivalvia). (Abstract) ASB [Association of Southeastern Biologists] Bulletin 23(2): 60.

Fuller, S. L. H., M. J. Imlay and James D. Williams. 1976. Endangered or threatened fresh-water mussels (Mollusca: Bivalvia: Unionidae) of the Waccamaw River basin of the Carolinas. (Abstract) ASB [Association of Southeastern Biologists] Bulletin 23(2): 60.

Davis, G. M., S. L. H. Fuller and C. Hesterman. 1977. Toward a definitive higher classification of North American Unionidae. (Abstract). Bulletin of the American Malacological Union, Inc. 1977: 85

Fuller, S. L. H. 1977. Freshwater and terrestrial mollusks. In: Cooper, J. E., S. S. Robinson, and J. B. Funderburg (eds.) Endangered and threatened plants and animals of North Carolina, North Carolina State Museum of Natural History, Raleigh, pp. 143–194.

Fuller, S. L. H. and J.W. Richardson. 1977. Amensalistic competition between *Corbicula manilensis* (Philippi), the Asiatic Clam (Corbiculidae), and freshwater mussels (Unionidae) in the Savannah River of Georgia and South Carolina (Mollusca: Bivalvia). (Abstract) ASB [Association of Southeastern Biologists] Bulletin 24(2): 52.

Fuller, S. L. H. 1978. Final Report. Fresh-water mussels (Mollusca: Bivalvia: Unionidae) of the upper Mississippi River: Observations at selected sites within the 9-foot channel navigation project on behalf of the United States Army Corps of Engineers. Report No. 78–33, 401 pp. Academy of Natural Sciences of Philadelphia. [June]

Fuller, S. L. H. 1978. Corps/Service cooperate to protect endangered mussels. Endangered Species Technical Bulletin 3(9): 3–6. Department of the Interior, U. S. Fish and Wildlife Service. Endangered Species Program, Washington, D.C. [September]

Fuller, S. L. H. 1978. The changing molluscan community. pp. 124–131. [in] Flynn, K. C. and W. T. Mason (Eds.). The freshwater Potomac: aquatic communities and environmental stresses. Proceedings of a symposium in January 1977, at College Park, Maryland. Interstate Commission of the Potomac River Basin, Rockville, Maryland. pp. 1–194.

Fuller, S. L. H. 1978. Freshwater mollusks, pp. 136–152. In: Zingmark, R. G. (ed.) An annotated checklist of the biota of the coastal zone of South Carolina. University of South Carolina Press, Columbia, South Carolina. pp. xii, 364.

Davis, G. M., S. L. H. Fuller and C. Hesterman. 1978. (Abstract) Bulletin of the American Malacological Union for 1977: 85.

Hart, Jr., C. W. and S. L. H. Fuller. 1979. Pollution Ecology of Estuarine Invertebrates. New York, Academic Press [editors only].

Fuller, S. L. H. 1979. Freshwater mussels (Mollusca: Bivalvia: Unionidae). In: Forsythe, D. M. and W. B. Ezell, Jr. (eds.) Proceedings of the first South Carolina endangered species symposium. South Carolina Wildlife and Marine Resources Department, Columbia. pp. 114–128.

Fuller, S. L. H., F. W. Grimm, T. L. Laavy, H. J. Porter and A. H. Shoemaker. 1979. Status Report: Freshwater and Terrestrial mollusks. In: Forsythe, D. M. and W. B. Ezell, Jr. (eds.) Proceedings of the first South Carolina endangered species symposium. South Carolina Wildlife and Marine Resources Department, Columbia, pp. 55–59.

Fuller, S. L. H. and Raymond H. Hartenstine. 1980. *Anodonta imbecillis* Say (Bivalvia: Unionidae) in the Delaware River Basin. The Nautilus 94: 4. [January 30]

Fuller, S. L. H. 1980. Final Report. Freshwater mussels (Mollusca: Bivalvia: Unionidae) of the upper Mississippi River: Observations at selected sites within the 9-foot navigation channel project for the St. Paul District. 1977–1979. Report No. 9–24F, vol. 1, 175 pp.; vol. 2, appendices, xiv + 401 pp., Academy of Natural Sciences of Philadelphia. [September]

Britton, J. C. and S. L. H. Fuller. 1980. The freshwater bivalve mollusca (Unionidae, Sphaeridae, Corbiculidae) of the Savannah River Plant, Aiken, South Carolina. Publication of the Savannah River Plant, National Environmental Research Park Program United States Department of Energy. SRO-NERP-3. pp. 1–37. [November]

Fuller, S. L. H. 1980. Historical and current distributions of freshwater mussels in the upper Mississippi River. pp. 72–119. In: Rasmussen, Jerry L. (ed.) Proceedings of the UMRCC symposium on upper Mississippi River bivalve Mollusks. Upper Mississippi River Conservation Committee, Rock Island, Illinois, 270 pp.

Fuller, S. L. H. 1980. Freshwater mussels of the upper Mississippi River, 2 pp. [This two-sheet, 30″ by 40″ poster was distributed by the United States Fish and Wildlife Service and the U. S. Army Corps of Engineers as an aid to mussel identification] E. Ambrogio and M. Fuges. [not seen]

Davis, G. M. and S. L. H. Fuller. 1981. Genetic relationships among Recent Unionacea (Bivalvia) of North America. Malacologia 20: 217–253 + 2 appendices

Davis, G. M., W. H. Heard, S. L. H. Fuller and C. Hesterman. 1981. Molecular genetics and speciation in *Elliptio* and its relationships to other taxa of North American Unionidae (Bivalvia). Biological Journal of the Linnean Society 15(2): 131–150.

Thomas, R. L., and S. L. H. Fuller. 1982. The freshwater mussel fauna of the Upper Mississippi River near locks and dam 19 at Keokuk, Iowa (Abstract 119). Abstracts of Contributed Papers. 94th session, Iowa Academy of Science, Fort Dodge, April 16–17, 1982 p.27.

Coney, C., S. L. H. Fuller, G. M. Davis, R. H. Moore, and J. M. Shipley. 1983. Adaptive radiation and convergence in the Cape Fear River basin Unionidae (Mollusca: Bivalvia). (Abstract). Bulletin of the South Carolina Academy of Science 45: 87–88.

Fuller, S. L. H. 1985. Freshwater mussels of the upper Mississippi River. 64 pp. Wisconsin Department of Natural Resources, Madison, Wisconsin. (Text by S. L. H. Fuller, Revision by Inga Byrnildson)

Bogan, A. E., J. D. Williams and S. L. H. Fuller. 1990. Comments on the proposed conservation of *Proptera* Rafinesque 1819 (Mollusca: Bivalvia). Bulletin of Zoological Nomenclature 4: 206–207. Case 2558.

Williams, J. D, S. L. H. Fuller and R. Grace. 1992. Effects of impoundments on freshwater mussels (Mollusca: Bivalvia: Unionidae) in the main channel of the Black Warrior and Tombigbee rivers in western Alabama. Alabama Museum of Natural History, Bulletin 13: 1–10. [September 25]

The following titles were referred to by Fuller in: An annotated checklist of the biota of the coastal zone of South Carolina (1978), but only abstracts under similar titles of some of them have appeared.

Fuller, S. L. H. and D. J. Bereza. 1975. A new genus-group name for *Unio ochraceus* Say. See: Bereza and S. L. H. Fuller (Fuller).

Fuller, S. L. H. and M. J. Imlay. 1976. A new genus-group for *Mya radiata* (Gmelin, 1791).

Fuller, S. L. H., M. J. Imlay and J. D. Williams. 1976. Freshwater-mussels (Mollusca: Bivalvia: Unionidae) in the Waccamaw River Basin of the Carolinas. See: Fuller, S. L. H., M. J. Imlay and J. D. Williams (1976).

Fuller, S. L. H., R. M. Shelley and M. J. Imlay. 1975. Fresh-water mussels (Mollusca: Bivalvia: Unionidae) in the Chowan River Basin of Virginia and North Carolina. See: Fuller, S. L. H.

ACKNOWLEDGMENTS

All quotations are from letters on file in the Department of Mollusks at the Museum of Comparative Zoology, Cambridge, Massachusetts. Some were sent to the Department, others were sent to William J. Clench, at home, for his eyes-only. Clench left his files to Ruth D. Turner who in turn left them to the Department. Some letters were personal to me. Mr. Henry Fuller made certain corrections to the manuscript regarding details of his brother's life and kindly supplied the photograph of him. Neither Mrs. Fuller nor daughter Rebecca deigned

to reply to several requests for information. Thanks are also extended to Mr. Daniel Elliott, Librarian of the Ewell Sale Stewart and Dr. Daniel L. Graf, Assistant Curator of Malacology of the Academy of Natural Sciences of Philadelphia, Ms. Susan DeSanctis, Ms. Mary B. Sears and Mr. Ronnie Broadfoot of the Ernst Mayr Library of the Museum of Comparative Zoology for locating and making available some of the works referred to.

ADDITIONAL LITERATURE CONSULTED

Abbott, R. T. 1973. American Malacologists. American Malacologists, Falls Church, 494 pp.

Hamilton, A. M. 2001. Fascination with mollusks led to a brilliant career. Hartford (Connecticut) Courant. p. H2. (A fitting encomium). [Sunday, October 2]

Erratum

In the article by Bouchet and Petit (2002), on page 100, under the "Remarks" section for the species *Merica marisca*, please replace the word *pirum* for *marisca*. The word *pirum* should have no nomenclatural standing within the context of that article.

LITERATURE CITED

Bouchet, P. and R. Petit. 2002. New species of deep-water Cancellariidae (Gastropoda) from the southwestern Pacific. The Nautilus 116: 95–104.

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